THE

PRINCIPLES AND PRACTICE

OF

AGRICULTURE,

&c. &c.

HARVEST

THE

PRINCIPLES AND PRACTICE OF AGRICULTURE,

SYSTEMATICALLY EXPLAINED;

IN TWO VOLUMES:

Being a Treatise compiled for the Fourth Edition of The ENCYCLOPÆDIA BRITANNICA,

AND REVISED AND ENLARGED BY

ROBERT FORSYTH, ESQ.

VOL. I.

EDINBURGH:

PRINTED BY THE PROPRIETOR, A. BELL.

AND SOLD BY ARCH. CONSTABLE & CO. EDINBURGH;
AND VERNOR & HOOD, LONDON.

1804.

[redacted]

Acc. no. 10962 15.9.76

A

SYSTEM

OF

AGRICULTURE.

LIBRARY 1859

CULTURE OF PARTICULAR PLANTS—CONTINUED.

3. Carrot.

Culture of carrot.

OF all roots, a carrot requires the deepeſt ſoil. It ought at leaſt to be a foot deep, all equally good from top to bottom. If ſuch a ſoil be not in the farm, it may be made artificially by trench-ploughing, which brings to the ſurface what never had any communication with the ſun or air. When this new ſoil is ſufficiently improved by a crop or two with dung, it is fit for bearing carrots. Beware of dunging the year when the carrots are ſown; for with freſh dung they ſeldom eſcape rotten ſcabs.

The only ſoils proper for that root are a loam and a ſandy ſoil.

The ground muſt be prepared by the deepeſt furrow that can be taken, the ſooner after harveſt the better; immediately upon the back of which, a ribbing ought to ſucceed, as directed for barley. At the end of March, or beginning of April, which is the time of ſowing the ſeed, the ground muſt be ſmoothed with a brake. Sow

Culture of particular Plants.

the ſeed in drills, with intervals of a foot for hand-hoeing: which is no expenſive operation where the crop is confined to an acre or two: but if the quantity of ground be greater, the intervals ought to be three feet, in order for horſe-hoeing.

In flat ground without ridges, it may be proper to make parallel furrows with the plough, ten feet from each other, in order to carry off any redundant moiſture.

Example of ſucceſsful culture.

An account is given, in the Annals of Agriculture, of a very correct mode of cultivating carrots, practiſed by a gentleman near Kidderminſter, in the county of Worceſter. "In the month of March he chooſes a very clean ſix or ſeven years ley. With a plough calculated for the purpoſe he ploughs off the turf to the depth of rather more than two inches, which, after the firſt bout, falls to the bottom of a deep furrow made by the ſecond plough; the ſecond plough ſucceeds the firſt in every particular furrow, and cuts the ground to the depth of 14 or 15 inches in the whole, that is, including the depth of the former furrow. He generally endeavours to ſow his ſeed about the 21ſt or 23d of this ſame month (March), not caring to be more early, as the young plants are very liable to be deſtroyed by the froſts which ſometimes occur early in the month of May. The ſowing he conducts in this manner:—He firſt directs a ſtrong and rather heavy harrow to be paſſed over the tillage; when this is fine, the ſeed is ſown in the broad-caſt manner. In order to diſtribute the ſeed, and to make it ſpread regularly in the caſting, ſome quarts of dry ſand are well mixed among it to fill the hand and keep it aſunder. The preciſe quantity of ſand is immaterial; he generally puts four quarts to a pound of the ſeed. This part of the proceſs, however, is in a great

degree

degree diſcretionary, the only objects being the regular diſtribution of the ſeed in the hopper and on the land. The ſeedſman muſt be careful to chooſe a day for this part of his buſineſs when there is very little wind, or he will perform it very imperfectly. At all times he muſt be careful to return near enough to his former caſt, the ſpecific gravity of the ſeed not admitting of extenſive caſts, like heavy grain. About three feet, perhaps, may ſerve as a mean width." Five pounds of good ſeed are uſually ſown on every acre; "more is ſuperfluous; for if ſtrong healthy plants actually ariſe and proceed from half a pound of the ſeed, the crop will be thick enough; and if two pounds of good ſeed do not produce plants in ſufficient number, four pounds will not, and the deficiency ought to be attributed to the ſeaſon. Good ſound ſeed may be known by rubbing it in the hand; if it be ſound, and have retained its virtues, by this treatment it will yield a ſtrong, aromatic, volatile oil, very pungent to the ſmell. But the particular ſort of carrot cannot be known by the ſeed; it can only be aſcertained by a careful inſpection of the roots themſelves: a deep orange colour, fine clear and ſmooth ſkin, and ſingle direct root, are qualities which diſtinguiſh the beſt. The ſeed ſhould be harrowed in with a light harrow, and the ſoil left very fine. In about ſeven, or perhaps it may be eight, weeks, the young plants will appear. If the organization and ſecretion in the plant be, and remain perfect to the point of the leaf, it is a pretty certain indication that the plant will thrive and proſper; but if there be any diſcoloration of that part, it is a ſymptom that it will ultimately become abortive. When the plants have ariſen to the height of about two inches, they ſhould be perfectly cleared from weeds by

Culture of particular Plants.

Culture of particular Plants.

the hand; and if they grow not more than ſix inches from each other, the crop will be ſufficiently thick." If they be nearer on an excellent ſoil, they ought to be reduced. "When they are ſtrong enough to ſtand againſt the hoe, they ſhould be well cleaned from weeds by this inſtrument; in doing which it will not be neceſſary to attend to the moulding up of the plants, but the beſt managers have the weeds well cleared away by the hand afterwards. If there be occaſion, the hoeing and cleanſing ſhould be repeated. Generally ſpeaking, the crop will pay for every attention of this kind."

Flanders mode of culture.

In his Agricultural Tour into France Mr Young obſerved in French Flanders a ſingular mode of cultivating carrots. "They ſow the ſeed at the ſame time, and on the ſame land, as flax, about Eaſter; that crop is pulled in July, the carrots then grow well, and the produce more profitable than any other application of the flax ſtubble. They yield, I gueſs, from 60 to 80 buſhels, and ſome more, per Engliſh acre; but what I ſaw were much too thick."

From Argentau to Bailleul the ſame traveller ſaw "carrots taken up and guarded, by building, in the neateſt and moſt effectual way againſt the froſt: they are topped, laid in round heaps, and packed cloſe with their heads outwards; and being covered with ſtraw in the form of a pyramid, a trench is digged around, and the earth piled neatly over the ſtraw to keep out the froſt. In this manner they are found perfectly ſecure."

At Parlington in Yorkſhire, from the end of September to the firſt of May, 20 work-horſes, four bullocks, and ſix milch cows, were fed on the carrots that grew on three acres; and theſe animals never taſted any other food but a little hay. The milk was excellent: and,

over and above, 30 hogs were fattened upon what was left by the other beaſts. We have this fact from undoubted authority. Culture of particular Plants.

Carrots have been greatly recommended as food for cattle, and, in this reſpect, bid fair to rival the potato; though, with regard to the human ſpecies, they are far inferior. The profit attending the cultivation of them, however, appears to be much more doubtful than that of potatoes. Mr Arthur Young informs us *, that from *Norden's Surveyor's Dialogue*, publiſhed in 1600, it appears, that carrots were commonly cultivated at that time about Orford in Suffolk, and Norwich in Norfolk; and he remarks, that the tract of land between Orford, Woodbridge, and Saxmundum, has probably more carrots in it than all the reſt of the kingdom put together." In 1779, few farmers in theſe parts had leſs than five or ſix acres; many from 10 to 20; and one had 36 acres: the ſtraight, handſome, and clean roots were ſent at 6d. per buſhel to London; the reſt being uſed at home, principally as food for horſes. In other counties, he obſerves, the culture of carrots had not extended itſelf; that ſome had begun to cultivate them in place of turnips, but had ſoon deſiſted; ſo that the culture ſeemed in a manner ſtill confined to the angle of Suffolk, where it firſt began. In attempting to inveſtigate the cauſe of this general neglect, he obſerves, that "the charge of cultivation is not ſo great as is commonly imagined, when managed with an eye to an extenſive culture, and not a confined one for one or two particular objects." Two acres which our author had

Much cultivated in Suffolk and part of Norfolk.

Why the culture has not extended itſelf.

* *Bath Papers*, vol. ii. p. 1.

Culture of particular Plants.

in carrots coſt 3l. 17s. 6d. per acre, including every expence; but had not the ſummer been dry, he obſerves, that his expences might have been much higher; and when he tried the experiment 15 years before, his expences, through inadvertence, ran much higher. His difficulty this year aroſe chiefly from the *polygonum aviculare*, the predominant weed, which is ſo tough that ſcarcely any hoe can cut it. Some acres of turnips which he cultivated along with the carrots were all eaten by the fly; but had they ſucceeded, the expence of the crop would have been 18s. 5d. leſs per acre than the carrots. "But (adds our author) if we call the ſuperiority of expence 20s. an acre, I believe we ſhall be very near the truth: and it muſt at once be apparent that the expence of 20s. per acre cannot be the cauſe of the culture ſpreading ſo little; for, to anſwer this expence, there are favourable circumſtances, which muſt not be forgotten. 1. They (the carrots) are much more impenetrable to froſt, which frequently deſtroys turnips. 2. They are not ſubject to the diſtempers and accidents which frequently affect turnips; and they are ſown at a ſeaſon when they cannot be affected by drought, which frequently alſo deſtroys turnips. 3. They laſt to April, when ſtock, and eſpecially ſheep farmers are ſo diſtreſſed, that they know not what reſource to provide. 4. The culture requiſite for turnips on a ſandy ſoil, in order to deſtroy the weeds, deſtroys alſo its tenacity, ſo that the crop cannot thrive; but with carrots the caſe is otherwiſe. Hence it appears, that the reaſon why the cultivation of carrots is ſtill ſo limited, does not ariſe from the expence, but becauſe the value is not aſcertained. In places where theſe roots can be ſent to London, or ſold at a good price, the

Superiority of carrots to turnips.

Difficulty of aſcertaining the value.

tops

tops being uſed as food for cattle, there is not the leaſt doubt that they are profitable; and therefore in ſuch places they are generally cultivated: but from the experiments as yet laid before the public, a ſatisfactory deciſive knowledge of the value is not to be gained. The moſt conſiderable practice, and the only one of common farmers upon a large ſcale, is that of the ſands of Woodbridge; but here they have the benefit of a London market, as already mentioned. Amongſt thoſe whoſe experiments are publiſhed, Mr Billingſley ranks foremoſt. Here again the value of carrots is rather depreciated than advanced; for he raiſed great crops, and had repeated experience upon a large ſcale of their excellence in fattening oxen and ſheep; feeding cows, horſes, and hogs; and keeping ewes and lambs in a very ſuperior manner, late in the ſpring, after turnips were gone: but notwithſtanding theſe great advantages, he gave the culture up; from which we may conclude a deficiency in value. "In ſeveral experiments (though not altogether determinate), I found the value, upon an average of all applications, to be 13d. a buſhel, heaped meaſure; eſtimating which at 70lb. weight, the ton is 1l. 14s." The following are the valuations of ſeveral gentlemen of the value of carrots in the way of fattening cattle: Culture of particular Plants.

	per ton.
Mr Melliſh of Blyth, a general valuation of horſes, cows, and hogs, -	L. 1 0
Mr Stovin of Doncaſter, hogs bought lean, fatted, and ſold off, - -	4 0
Mr Moody of Ratford, oxen fatted, and the account accurate, - -	1 0 0

Culture of particular Plants.

	per ton.
Mr Taylor of Bifrons, ſaving of hay and corn in feeding horſes, - -	1 0 0
Mr Le Grand of Aſh, fattening wethers,	0 13 9
Sir John Hobby Mill of Biſham, fattening hogs, - - - -	1 6 0
Mr Billingſley, for fattening hogs, -	1 13 6

Some other gentlemen whom our author conſulted, could not make their carrots worth any thing: ſo that, on the whole, it appeared to him a matter of the utmoſt doubt, ſo contradictory are the accounts, whether the culture of carrots be really attended with any profit or not. Thus Sir John Mill, by fattening hogs, makes 1l. 6s. and Mr Stovin 4l.; but others could not fatten hogs upon them at all: and ſome of Mr Young's neighbours told him, that carrots were good for nothing except to *ſcour* hogs to death. The experiment of Mr Le Grand upon wethers appeared to be made with the greateſt accuracy; yet two circumſtances ſeem to militate againſt it. 1. The ſheep were put lean to them; whereas it is a fact well known, that if they are not half fat when put to turnips, no profit will reſult; and it is poſſible that the caſe may be the ſame with carrots. 2. He gave them alſo as much fine hay as they would eat.

New experiments recommended.

In this uncertain ſtate of the matter, the only thing that this author could adviſe was, to make a number of experiments with as much accuracy as poſſible, in order to aſcertain the real value per ton: and he endeavours to ſhow, that there is no danger of loſing much by experiments of this kind. "I have ſhown (ſays he), that they are to be cultivated for 4l. per acre, left on the ground for ſheep. Suppoſe the crop only two buſhels

at

at 70lb. each per rood, 320 per acre, or ten tons; it will readily be agreed that ſuch a produce is very low to calculate upon, ſince 20 tons are common among carrot-cultivators. It appears from Mr Le Grand's experiments, that a wether worth 2l. 5s. eats 16lb. of carrots, and four pounds of hay per day: dropping the hay, and calculating for ſheep of leſs than half that ſize (which are much more common), it will be perhaps an ample allowance to aſſign them 12lb. of carrots a day. If they are, as they ought to be, half fat when put up, they will be completely fattened in 100 days. At this rate, 20 wethers will, in 100 days, eat 11 tons, or very little more than one moderate acre. Now, let it be remembered, that it is a good acre of turnips which will fatten eight ſuch wethers, the common Norfolk calculation: from which it appears, that one acre of carrots is, for this purpoſe, of more value than two of turnips. Further, let us ſuppoſe horſes fed with them inſtead of oats: to top, cart, and pack up, 10 tons of carrots, I know may be done for 20s.—An acre therefore (other expences included) coſts 5l. Fifty pounds weight of carrots are an ample allowance for a horſe a day: ten tons, at that rate, laſt three horſes for five months. But this 5l. laid out in oats at 16s. per quarter, will purchaſe little more than ſix quarters; which will laſt three horſes, at two buſhels each per week, no more than two months; a moſt enormous inferiority to the carrots." Culture of particular Plants.

In the ſame volume, p. 187. Mr Young gives an account of another experiment made by himſelf on the feeding of lambs with carrots. The quantities they ate varied exceſſively at different times; thirty-ſix of them conſumed from five to ten buſhels per day; but on an average, Experiment on feeding lambs with them.

Culture of particular Plants.

average, he rates them at four buſhels of 56 pounds per day. In all, they conſumed 407 buſhels from November to April, when they were ſold and killed fat. At putting upon the carrots, the lambs were valued only at 18l. but were ſold in April at 25l. 4s.; ſo that the value of the carrots was exactly 7l. 4s. or about 4d. per buſhel. This price he ſuppoſes to be ſufficient to induce any one to attempt the culture of carrots, as thus he would have a clear profit of 40s. per acre; "which (ſays he) is greater than can attend the beſt wheat crops in this kingdom." The land on which the carrots grew was ſown next year with barley, and produced the cleaneſt in the pariſh; which contradicts an aſſertion our author had heard, that carrots make land foul. The graſs upon which the ſheep were fed with the carrots, and which amounted to about an acre, was very little improved for the crop of hay in 1781, owing to the dryneſs of the ſeaſon; but in 1782 was greatly ſuperior to the reſt of the field, and more improved in quantity: "for, inſtead of an indifferent vegetation, ſcattered thick with the *centaurea ſcabioſa*, *filago*, *rhinanthus. criſta galli* and *linum catharticum*, with other plants of little value, it encouraged a very beautiful ſheet of the beſt plants that can appear in a meadow, viz. the *lathyrus pratenſis*, *achillea millefolium*, *trifolium repens*, *trifolium ochroleucrum*, *trifolium alpeſtie*, and the *plantago lanceolata*.

Carrots compared with cabbages.

In the ſame volume of the Bath papers, p. 227, Mr Billingſley gives an account of the comparative profit of carrots and cabbages. Of the former, however, he obtained only ſeven tons 15 cwt. per acre; the cabbages produced 36 tons: nevertheleſs, according to him, the profit of the former was 5l. 8s.; of the latter, only

3l.

3l. 11s. In a paper on the culture of carrots by Mr Kirby of Ipſwich, vol. iii. p. 84. he informs us, that he never determined the weight of an acre, but reckons the produce from 200 to 500 buſhels; which, at 56lb. to the buſhel, is from five to ten tons and a half. In the ſame volume, p. 320, the Rev. Mr Onley ſeems to prefer the culture of carrots to potatoes. "However valuable (ſays he), from eaſe of culture, and greatneſs of produce to the poor, eſpecially in all ſmall ſpots, I doubt, unleſs near great towns, whether on a farming plan, potatoes be ſo eligible as other herbage or roots, eſpecially as carrots, which I cannot but *ſurmiſe* (for my trials are too trivial to venture bolder language), deſerve every encouragement, even on ſoils hitherto thought too heavy for them.—I am from experience convinced, that an acre of carrots will double in the quantum, of equally hearty provender, the product of an acre of oats; and from the nature of their vegetation, the nice mode of cultivation, and even of taking them up (all of which, expenſive as they are, bear a very inferior proportion to the value of a medium crop), muſt leave the land, eſpecially if taken off it in an early period, ſo mellow for the plough, as to form a ſeed-bed for barley equal to any fallow-tilth."

Culture of particular Plants.

Culture of carrots preferred to potatoes.

Mr. Onley's deſideratum was a ſubſtitute for oats to feed horſes; of which great numbers are kept in his county (Eſſex). Potatoes, he obſerves, are excellent for *ſmall* pork, when baked or boiled, mixed with a little barley meal; but for large hogs, they are moſt profitably given raw, if theſe have at the ſame time the ſhack of the barn door in thraſhing ſeaſon, &c. In the 5th volume he reſumes the ſubject, and acquaints us, that he applied a ſingle acre in his bean field to the

culture

Culture of particular Plants.

culture of carrots, which generally produced 400 buſhels; and this he conſiders as a ſmall produce. "I am, however, ſenſible (ſays he) that they will amply repay every expence of the fineſt culture; and ſhould, from their extenſive utility on ſound, deep, and friable land, be everywhere attempted. Some of my neighbours, who have been induced to try them on rather a larger ſcale, with finer culture, and freſher ſoil, have raiſed from 600 to 900 buſhels per acre, and applied them more profitably, as well as more generally, than any other winter herbage, to deer, ſheep, bullocks, cows, and horſes. At the loweſt calculation, from our little trials, they are computed to exceed turnips in value one-third, as to quantity of food; but are far ſuperior in what ariſes from convenience for the ſtable; where, to us, they ſeem to be a ſubſtitute for corn to all horſes, at leaſt ſuch as are not uſed in any quick work; and partially ſo with corn for thoſe that are."

Superior to turnips and oats.

In making a compariſon betwixt the profit on oats and carrots, Mr Onley found the latter exceed by no leſs than 2l. 15s. 8d. per acre. His method of cultivation is to ſow them in March or April; to hoe them three times, harrowing after each hoeing. Sometimes he left them in the ground till after Chriſtmas, taking them up as wanted; but afterwards he took them up in October, in dry days, putting them directly into ſmall upright cocks of 10 buſhels each, covered entirely, with the tops cut off.—Thus they appear to dry better than in any other way, and bear the weather with very little loſs. If, after being thus dried, they are carried into any barn or ſhed, it will be better, if they are in large quantities, not to pack them cloſe, on account of the danger of heating, but rather to throw them promiſcuouſly

promiſcuouſly into heaps, with a little ſtraw over them. When perfectly dry, they do not in general require any waſhing, except for horſes regularly kept in the ſtable. Culture of particular Plants.

This root has been found ſo generally valuable as a ſubſtitute for grain in feeding horſes, that its uſe in that way is rapidly ſpreading into various parts of the country. By the quantity of ſaccharine matter which it contains, it is probably rendered extremely rich and ſtimulating to the ſtomach of that delicate animal, ſo that a leſs quantity of it goes to waſte than of any other food. We may remark, that the gentleman already mentioned, Mr Onley, who had the merit of preſſing upon the public attention the importance and utility of this root, mentions an uſe to which we believe it is not unfrequently applied in the dairy*. "In our dairies (ſays he) as many carrots are bruiſed before churning, as produce, ſqueezed through a cloth into as much cream as make eight or ten pounds of butter, an half pint of juice; this adds ſomewhat to the colour, richneſs, and flavour of winter butter; and we think, where hay is allowed beſides, contributes much to counteracting the flavour from the feed of turnips. At preſent (our carrot feed being exhauſted) from turnips and hay, with this juice, our butter is equal to that of the Epping dairies." Carrots now more generally uſed. Carrots uſed to colour butter.

An experiment that has been made of the poſſibility of cutting the tops of carrots to be uſed as green food for cattle, without injury to the roots, is too important and curious to be paſſed here unnoticed. It is ſtated in a letter Carrot-tops uſed as green food.

* *Annals of Agriculture*, vol. xii.

Culture of particular Plants.

ter from Henry Vavaſour, Eſq. to the editor of the Annals of Agriculture *. "Laſt ſpring I ſowed, broad-caſt, two acres of carrots following a potato crop on a light ſandy loam of twenty ſhillings an acre. They were twice hoed at thirteen ſhillings the two, in the manner of hoeing turnips; and in the courſe of ſummer I mowed one third of the tops twice: another third of the tops I mowed once; and the remaining third of the crop the ſcythe did not paſs over. The tops were greedily devoured by my horſes, cattle, and pigs, in the fold-yard: and were equal in quantity and value to a conſiderable crop of clover cut and made uſe of in the ſame mode.

"At the end of October I took up the carrot-roots, and preſerved them in a trench in the manner of potatoes. The crop was full ſix hundred buſhels per acre; and it was not found that the roots of thoſe carrots, whoſe tops had been twice cut, were at all inferior in ſize or quality to thoſe whoſe tops had been left untouched. A paſſage was left for a ſmall cart to carry off the tops, and another I made by drawing the young carrots wanted for family uſe.

"I have reaſon to conſider this mode of cultivating carrots equal to the beſt fallow crop, provided the carrots are twice well hoed, and the tops are cut off, as the ſcythe prevents any weeds ſeeding in the autumn.

Poultry fed with carrots.

"My horſes, oxen, milch-cows, and pigs, are at this time eating the carrot-roots; my turkies and other poultry have them boiled, and are fatted well upon them; even my pigeons are fed upon carrots, as they conſtantly

* Vol. xxiv.

ly attend in the fold-yard to pick up every particle that drops from the mouths of the cattle; which ſupply is ſufficient to keep my pigeons at home, and to ſave an expence in feeding them during the ſevere weather. Culture of particular Plants.

"The market price for carrots, near my houſe, twelve miles eaſt of York, is from ten pence to one ſhilling per buſhel: at which price it muſt be allowed that the crop is a profitable one.

"I muſt obſerve, that the demand for carrots in this neighbourhood is become not inconſiderable for ſtallions; for it is found, that this food is more invigorating and fattening than any other that can be given to them."

We may conclude by taking notice here of an advantageous mode of cultivating carrots by making use of them with a view to ſtir the ground in young plantations. It was adopted by Thomas Walford, Eſq. of Birdbrooke, Eſſex, who gives the following account of it:—"It has been my conſtant practice for theſe laſt five years, wherever I made a plantation of firs, or deciduous trees, to ſow the ground in the ſpring with carrots, which I have found not only to pay part of my expences, and frequently the whole, but to be much more beneficial to the trees than any other method I had before adopted. Carrots advantageouſly cultivated in young plantations.

"When I make a plantation of deciduous trees, the ground is dug two ſpits deep in October, and planted immediately, leaving it in that ſtate until the middle or latter end of March, or beginning of April; then, if neceſſary, I chop it over with a hoe, and ſow my carrots: if for firs, I do not dig the ground until March, at which time I plant my trees, and ſow the carrots, having found

Culture of particular Plants.

my crop more luxuriant and productive upon ground freſh dug than that which was dug in the autumn.—I give for digging 8d. per rod; hoe only twice; the produce is generally four buſhels of clean carrots, which I ſell at 6d. per buſhel, the buyer to fetch them from their place of growth.

"The ſoil in ſome places, looſe and hollow; the under ſtratum clay; in others a fine vegetable mould upon a red loam.

"I find in taking up the carrots, leſs damage is done to the young fibres of the trees, than by digging between them; for, it is impoſſible, with the greateſt care of your ſervants, not to cut off ſome of them by digging, and thereby injure the trees, beſides leaving the ground in no better ſtate than it is after carrots; for when the carrot is drawn, the cavity is filled immediately with looſe mould, through which the young fibres will ſtrike with great freedom, and very much accelerate the growth of the trees."

4. Parsnips.

The cultivation of parſnips too much neglected.

Parſnips have never in this country received from huſbandmen that attention to which they are well entitled from the eaſe with which they are cultivated, and the great quantity of ſaccharine or nouriſhing matter they are known to contain, which certainly abounds in them in a much greater proportion than in almoſt any other vegetable with which we are at preſent acquainted.

To cultivate this root* (ſays Mr Hazard) ſo as to make

* *Bath Papers*, vol. iv. p. 244.

make it advantageous to the farmer, it will be right to ſow the ſeed in the autumn immediately after it is ripe; by which means the plants will appear early the following ſpring, and get ſtrong before the weeds can riſe to injure them. Neither the ſeeds nor young plants are ever materially injured by froſts; on which account, as well as many others, the autumn is preferable to the ſpring ſowing. The beſt ſoil for them is a rich deep loam, and next to this ſand. They will thrive well in a black gritty ſoil, but not in ſtone-braſh, gravel, or clay; and they are always largeſt in the deepeſt earth. If the ſoil be proper, they do not require much manure. Mr Hazard obtained a very good crop for three years upon the ſame piece of ground without uſing any; but when he laid on about 40 cart loads of ſand per acre upon a ſtiff loam, and ploughed it in, he found it anſwer very well; whence he concludes, that a mixture of ſoils may be proper for this root. The ſeed may be ſown in drills to about 18 inches diſtance from one another, that the plants may be the more conveniently hand or horſe-hoed; and they will be more luxuriant if they undergo a ſecond hoeing, and are carefully earthed, ſo as not to cover the leaves. Such as have not ground to ſpare, or cannot get it in proper condition in autumn, may at that time ſow a plot in their garden, and tranſplant from thence in the latter end of April, or early in the month of May following. The plants muſt be carefully drawn, and the ground well pulverized by harrowing and rolling; after which a furrow ſhould be opened with the plough, about ſix or eight inches deep, in which the plants ſhould be regularly laid at the diſtance of about ten inches from each other, taking care not

Culture of particular Plants.

Mr Hazard's method of cultivation.

Culture of particular Plants.

to let the root be bent, but the plant to ſtand perpendicular after the earth is cloſed about it, which ought to be done immediately by means of perſons who ſhould for this purpoſe follow the planter with a hoe. Another furrow muſt be opened about 18 inches from the former, in the ſame direction, and planted as before; and ſo on in like manner until all the plants are depoſited, or the field be completely cropped; and, when the weeds appear, hoeing will be neceſſary, and it will afterwards be proper to earth them; but if the leaves of the plants be covered with earth, the roots will be injured. Parſnips ought not to be planted by dibbling, as the ground thus becomes ſo bound as ſeldom to admit the ſmall lateral fibres with which theſe roots abound to fix in the earth, by which they are prevented from expanding themſelves, and never attain a proper ſize. When circumſtances are properly attended to, there is little doubt that a crop of parſnips would anſwer much better than a crop of carrots. They are equal, if not ſuperior, in fattening pigs, as they make their fleſh whiter, and the animals themſelves are more fond of theſe roots than of carrots. Horſes eat them greedily when clean waſhed and ſliced among bran, and thrive very well upon them; and black cattle likewiſe greatly approve of them.

Culture in France.

Though parſnips are little uſed in Britain, they are highly eſteemed in ſome diſtricts of France. In Britanny they are thought, as food for cattle, to be little inferior to wheat; and cows fed with them are ſaid to give as much milk, and of as good quality, as in the ſummer months.

Mr Young ſtates, in the following terms, his obſervations upon the ſubject when travelling in that province.

vince. "*Ponton* to *Morlaix*.—Many parſnips cultivated about a league to the left; they are ſown alone and hoed. They are given to horſes, and are reckoned ſo valuable that a journal is worth more than one of wheat. Nearer to Morlaix the road paſſes a few ſmall pieces. They are on beds five or ſix yards broad with trenches digged between, and on the edges of thoſe trenches a row of cabbages. Culture of particular Plants.

"*Morlaix*.—About this place, and in general through the biſhopric of St Pol de Leon, the culture of parſnips is of very great conſequence to the people. Almoſt half the country ſubſiſts on them in winter, boiled in ſoup, &c. and their horſes are generally fed with them. A horſe load of about 300lb. ſells commonly at three livres, in ſcarce years at four livres, and ſuch a load is good food for a horſe 15 days. At 60lb. to the buſhel, this is five buſhels; and 2s. 7½d. for that, is 6½d. per buſhel of that weight. I made many inquiries how many loads on a journal, but no ſuch thing as information tolerably to be depended upon; I muſt therefore gueſs the preſent crop by the examination I made of many, to amount to about 300 buſhels or 350 per Engliſh acre. The common aſſertion, therefore, that a journal of parſnips is worth two of wheat ſeems to be well founded. The ground is all digged a full ſpit deep for them; they are kept clean by hand-weeding very accurately, but are left for want of hoeing beyond all compariſon too thick. They are reckoned the beſt of all foods for a horſe, and much exceeding oats; bullocks fatten quicker and better on them than on any other food; in ſhort they are, for all ſorts of ſtock, the moſt valuable produce found on a farm. The ſoil is a rich deep friable ſandy loam."

Culture of particular Plants.

In the iſland of Jerſey, parſnips have long been conſidered as of the higheſt importance; and as the mode of cultivating them there ſeems worthy of attention, we ſhall here give an account of it, from a paper tranſmitted by the Agricultural Society of Jerſey to the Britiſh Board of Agriculture.

Culture of parſnips with beans in Jerſey and Guernſey.

"It is impoſſible, ſay theſe gentlemen, to trace the period when the cultivation of this plant was firſt introduced amongſt us. It has been known for ſeveral centuries, and the inhabitants have reaped ſuch benefit therefrom, that, for fattening their cattle and pigs, they prefer it to all the known roots of both hemiſpheres. The cattle fed therewith yield a juicy and exquiſite meat. The pork and beef of Jerſey are inconteſtably equal, if not ſuperior, to the beſt in Europe. We have obſerved, that the beef in ſummer is not equal to that in the autumn, winter, and ſpring periods, when the cattle are fed with parſnips; which we attribute to the excellency of that root.

"All animals eat it with avidity, and in preference to potatoes. We are ignorant of the reaſon, having never made any analyſis of the parſnip. It would be curious, intereſting, and uſeful, to inveſtigate its characteriſtic principles: it is certain that animals are more fond of it than of any other root, and fatten more quickly. The parſnip poſſeſſes, without doubt, more nutritious juices than the potato. It has been proved that the latter contains eleven ounces and a half of water, and one gros of earthy ſubſtance, French weight; therefore, there only remain four ounces and five gros of nutritive matter. Probably the parſnip does not contain near ſo much watery particles; nevertheleſs, they digeſt very eaſily in the animal's body. The cows

fed

fed with hay and parſnips during winter yield butter of a fine yellow hue, of a ſaffron tinge, as excellent as if they had been in the moſt luxuriant paſture." Culture of particular Plants.

Theſe gentlemen proceed to ſtate, that, in the iſland of Jerſey, parſnips are not cultivated alone, but along with beans, among which laſt peaſe are ſometimes mixed. There are three modes of cultivation: 1ſt, With the ſpade; 2d, With the plough and ſpade; and 3d, With two ploughs, the one called the ſmall and the other the great plough. This laſt method, as being the moſt economical and advantageous to the huſbandman, is the only one deſcribed. In the month of September, a ſlight ploughing and preparation is ſometimes given to the field deſtined for beans and parſnips in the enſuing year; but more generally the whole work is performed in high grounds about the middle of February, and in the middle of March in low land. A light plough cuts and turns the earth about four or five inches deep; then follows it a large plough conſtructed on purpoſe, and only uſed for this operation, which elevates the earth on the furrow laid open, and turns it over that which the ſmall plough turned up. The eſſential point is to plough deep, and to cover the clods over again.

The field thus prepared, is ſuffered to remain 15 days, after which it is very lightly harrowed. On the ſame day, or on the enſuing, the beans are planted in the following manner. Straight lines muſt be drawn from north to ſouth with a gardener's rake at 4½ feet diſtance. On theſe ſtraight lines, 19 inches in breadth, women plant four or five beans in rows four inches diſtant from each other, or the beans are planted in double rows all over the field, at the uſual depth, and 12 feet diſtance from each other, with the beans ſpaced out 18 inches from

Culture of particular Plants.

each other. When all this is done, the parſnips are ſown in broad-caſt over the field, after which it is well harrowed. In 15 days after, if the weather has been warm and rainy, or in three weeks if it has been cold and dry, the ground is harrowed again to cut up the weeds. In five or ſix weeks the beans ſhoot out, and the ground ſoon appears as if covered by hedges or laid out in paths for walking; for in the ſpaces between the lines where the beans were planted are as many alleys, where women and children weed with great facility. They generally weed the ground twice, and the operation is performed with a two-pronged fork, ſuch as is uſed in gardens. The firſt weeding is performed at the end of April or beginning of May, when the plants muſt be cleared out if they are too thick. When the beans are ripe, which is in Auguſt or September, they are immediately plucked up, not to incommode the parſnips. The crop of beans is not always certain. If high winds or fogs prevail when they are in flower, the produce will be ſcanty; but the parſnips in a manner never fail. They neither dread the inclemency of the weather, nor are affected by the hardeſt froſt, nor by any of thoſe accidents which at times will inſtantly deſtroy a whole crop.

Parſnips grow till the end of September, but ſome give them to cattle they wiſh to fatten in the beginning of September. The people of theſe iſlands conſider the parſnip as the moſt juicy and nutritious of all roots known. Its cultivation is an excellent preparation for wheat, which is ſown there without manure after parſnips, and yields a plentiful crop. It muſt be obſerved, that though this cultivation of parſnips is expenſive where the price of labour is high, no dung or manure

manure is neceſſary either for the parſnips or the wheat. They reckon 30 perches of parſnips, with a little hay, will fatten an ox of three or four years old, though ever ſo lean: he eats them in the courſe of three months as follows; they are given at ſix in the morning, at noon, and at eight at night, in rations of 40lb. each; the largeſt are ſlit into three or four pieces; but not waſhed unleſs very much covered with earth. In the intermediate hours, at nine in the morning, two in the afternoon, and nine at night, a little hay is given. Experience has ſhewn, that when cattle, pigs, or poultry, are fed with parſnips, they are ſooner fattened and are more bulky than with any other root or vegetable whatever. The meat of ſuch is moſt delicate and ſavoury. In ſpring the markets are furniſhed with the beſt and fatteſt beef from their feeding on parſnips. The crops of parſnips raiſed in Jerſey and Guernſey are very great. On an extent of 1000 feet, the produce of a field of beans and parſnips is about 1200lb weight of parſnips, Rouen meaſure, and thirty cabots or half buſhels of beans, and three cabots and a half of peaſe; which altogether, according to the price at which theſe articles are actually ſold there, amount to the ſum of 256 livres French currency. The following information was alſo received from the preſident of the Jerſey Society on 1ſt March 1796, viz. "Since writing concerning the crop of beans and parſnips together, we have found that an individual who cultivates parſnips without ſowing either peaſe or beans along with them had a crop of 14,760lb. weight of Rouen meaſure per vergee." The vergee is 40 perches in length and one perch in breadth.

Culture of particular Plants.

Culture of particular Plants.

III. *Plants cultivated for Leaves, or for both Leaves and Root.*

I. TURNIP-ROOTED CABBAGE.

Cultivation of the turnip rooted cabbage.

This plant may deſervedly be reckoned next in value to the turnip itſelf. Its advantages, according to Sir Thomas Beevor, are, "that it affords food for cattle late in the ſpring, and reſiſts mildew and froſt, which ſometimes deſtroy the common turnip;" whence he is of opinion that every farmer who cultivates the common turnip ſhould always have part of his farm laid out in the cultivation of this root. The importance and value of turnip-rooted cabbages ſeem only to have been lately aſcertained. In the Bath Society papers we have the following account of Sir Thomas Beevor's method of cultivating them; which from experience he found to be cheaper and better than any other.

"In the firſt or ſecond week of June, I ſow the ſame quantity of ſeed, hoe the plants at the ſame ſize, leave them at the ſame diſtance from each other, and treat them in all reſpects like the common turnip. In this method I have always obtained a plentiful crop of them; to aſcertain the value of which I need only inform you, that on the 23d day of April laſt, having then two acres left of my crop, ſound, and in great perfection, I divided them by ſold hurdles into three parts of nearly equal dimenſions. Into the firſt part I put 24 ſmall bullocks of about 30 ſtone weight each (14lb. to the ſtone), and 30 middle-ſized fat weathers, which, at the end of the firſt week, after they had eaten down the greater part of the leaves, and ſome part of the roots, I ſhifted into the ſecond diviſion, and then

Their utility and value.

put

put 70 lean ſheep into what was left of the firſt; theſe fed off the remainder of the turnips left by the fat ſtock; and ſo they were ſhifted through the three diviſions, the lean ſtock following the fat as they wanted food, until the whole was conſumed. Culture of particular Plants.

" The 24 bullocks and 30 fat weathers continued in the turnips until the 21ſt of May, being exactly four weeks; and the 70 lean ſheep until the 29th, which is one day over four weeks: ſo that the two acres kept me 24 ſmall bullocks and 110 ſheep four weeks (not reckoning the overplus day of keeping the lean ſheep); the value, at the rate of keeping at that ſeaſon, cannot be eſtimated in any common year at leſs than 4d. a-week for each ſheep, and 1s. 6d. per week for each bullock, which would amount together to the ſum of 14l. 10s. 8d. for the two acres.

" You will hardly, I conceive, think I have ſet the price of keeping the ſtock at too high a rate; it is beneath the price here in almoſt every ſpring, and in this laſt it would have coſt double, could it have been procured: which was ſo far from being the caſe, that hundreds of ſheep and lambs here were loſt, and the reſt greatly pinched, for want of food.

" You will obſerve, gentlemen, that in the valuation of the crop above mentioned I have claimed no allowance for the great benefit the farmer receives by being enabled to ſuffer his graſs to get into a forward growth, nor for the ſuperior quality of theſe turnips in fattening his ſtock; both which circumſtances muſt ſtamp a new and a great additional value upon them. But as their continuance on the land may ſeem to be injurious to the ſucceeding crop, and indeed will deprive the farmer totally of either oats or barley; ſo to

ſupply

Culture of particular Plants.

ſupply that loſs I have always ſown buck-wheat on the firſt earth upon the land from which the turnips were thus fed off; allowing one buſhel of ſeed per acre, for which I commonly receive from five to ſix quarters per acre in return. And that I may not throw that part of my land out of the ſame courſe of tillage with the reſt, I ſow my clover or other graſs ſeeds with the buck-wheat, in the ſame manner as with the oat or barley crops, and have always found as good a *layer* (ley) of it afterwards.

"Thus you ſee, that in providing a moſt incomparable vegetable food for cattle, in that ſeaſon of the year in which the farmer is generally moſt diſtreſſed, and his cattle almoſt ſtarved, a conſiderable profit may likewiſe be obtained, much beyond what is uſually derived from his former practice, by the great produce and price of a crop raiſed at ſo eaſy an expence as that of buck-wheat, which with us ſells commonly at the ſame price as barley, oftentimes more, and but very rarely for leſs.

"The land on which I have uſually ſown turnip-rooted cabbages is a dry mixed ſoil, worth 15s. per acre."

To the preceding account the Society have ſubjoined the following note: "Whether we regard the importance of the ſubject, or the clear and practical information which the foregoing letter conveys, it may be conſidered as truly intereſting as any we have ever been favoured with: and therefore it is recommended in the ſtrongeſt manner to farmers in general, that they adopt a mode of practice ſo deciſively aſcertained to be in a high degree judicious and profitable."

Recommendation by the Bath Society.

To raiſe the turnip-rooted cabbage for tranſplanting, the

the beſt method yet diſcovered is, to breaſt-plough and burn as much old paſture as may be judged neceſſary for the ſeed-bed; two perches well ſtocked with plants will be ſufficient to plant an acre. The land ſhould be dug as ſhallow as poſſible, turning the aſhes in; and the ſeed ſhould be ſown the beginning of April. Culture of particular Plants.

The land intended for the plantation to be cultivated and dunged as for the common turnip. About midſummer (or ſooner if the weather will permit) will be a proper time for planting, which is beſt done in the following manner: the land to be thrown into *one-bout* ridges, upon the tops of which the plants are to be ſet, at about 18 inches diſtance from each other. As ſoon as the weeds riſe, give a hand-hoeing; afterwards run the ploughs in the intervals, and fetch a furrow from each ridge, which, after lying a fortnight or three weeks, is again thrown back to the ridges; if the weeds riſe again, it is neceſſary to give them another hand-hoeing. To raiſe the turnip-rooted cabbage for tranſplanting.

If the young plants in the ſeed-bed ſhould be attacked by the fly, ſow wood-aſhes over them when the dew is on, which will effectually prevent the ravages they would otherwiſe make.

In another letter from Sir Thomas Beevor, Bath Papers, vol. viii. p. 489. he expreſſes his hope that the turnip-rooted cabbages he had would laſt until he ſhould have plenty of graſs for all his ſtock. To make a comparative eſtimation of the quantity of food yielded by the turnip-rooted cabbage and the common turnip, he ſelected ſome of each kind, and having girted them with as much accuracy as poſſible; he found, that a turnip-rooted cabbage of 18 inches circumference weighed 5¼lb. and a common turnip of the ſame ſize Compariſon of the quantity of food in this and in the common turnip.

only

Culture of particular Plants.

only 3½lb.; on trying others, the general reſult was found to be in that proportion. Had they been weighed with the tops, the ſuperiority of the turnip-rooted cabbage would have been greater, the tops of them being remarkably buſhy. They were weighed in the month of March; but had this been done at Chriſtmas, our author is of opinion that the difference would not have been ſo great; though he reckons this very circumſtance of their continuing ſo long to afford a nouriſhing food, an inſtance of their excellency above almoſt every other vegetable whatever.

Other experiments.

In the fourth volume of the ſame work, Sir Thomas gives an account of another experiment on five acres of turnip-rooted cabbage, four of which were eaten upon the field, the other was pulled up and carried to the ſtables and ox-houſes. They were ſown and cultivated as other turnips; the beaſts were put to them on the 12th of April, and continued feeding upon them till the 11th of May. The cattle fed for this ſpace of time were, 12 Scotch bullocks weighing 40 ſtone each; eight homebreds, two years old; fifteen cows full-ſized; 40 ſheep; 18 horſes; beſides 40 ſtore-hogs and pigs, which lived upon the broken pieces and offal, without any other allowance, for the whole four weeks. The whole value of the plant, excluſive of the feeding of the pigs, amounted, according to our author's calculation, to 18l.; and he ſays that the farmers would willingly give this ſum in the ſpring for feeding as many cattle: "becauſe it enables them to ſave the young ſhooting graſs (which is ſo frequently injured by the tread of the cattle in the froſty nights) until it gets to ſuch a length and thickneſs as to be afterwards but little affected by the ſummer's drought.

Beſides

Beſides this, the tops or leaves are in the ſpring much more abundant, and much better food than thoſe of the common turnip, as already obſerved; and they continue in full perfection after all the common turnips are rotten or worthleſs. Culture of particular Plants.

The diſadvantages attending the cultivation of turnip-rooted cabbages are, that they require a great deal of time and pains to take them up out of the ground, if they are to be carried off the field; and if fed where they grow, it requires almoſt an equal labour to take up the pieces left by the cattle. A great deal of earth is alſo taken up along with the root; and the ſubſtance of the latter is ſo firm and ſolid, that they muſt be cut in two in order to enable the cattle to eat them. To obviate ſome of theſe objections, it will be proper to ſow the plants on rich and very light land; and as they are longer in coming to the hoe than the common turnip, it will be proper to ſow them about the beginning of June. Diſadvantages attending the cultivation of this plant.

In another experiment upon this plant by the ſame gentleman, the cabbages held out during the long and ſevere froſt of 1788 without the leaſt injury, though it deſtroyed three-fourths of all the common turnips in the neighbourhood. On the 21ſt of April 1789, the average produce of an acre was found to be ſomewhat more than 24½ tons, though the tops had not ſprouted above three inches. Conſidering the precarioufneſs of turnips and other crops, Sir Thomas is deciſively of opinion, that all farmers ought to have as many turnip-rooted cabbages as would afford and enſure them a full proviſion for their cattle for about three or four weeks during the latter part of the ſpring. This quantity he reckons ſufficient, as the conſumption, particularly Why every farmer ought to cultivate this plant.

when

Culture of particular Plants.

when drawn and carried off the land, is attended with more trouble and expence than that of common turnips, eſpecially if the ſoil be wet and heavy. In another letter, dated May 3. 1790, Sir Thomas Beevor once more ſets forth the advantages of having a crop of theſe vegetables during the ſpring ſeaſon. "In conſequence (ſays he) of the very cold weather we have had here, the graſs is but juſt ſpringing; as the turnips are wholly eaten up, it occaſions much diſtreſs among the farmers for want of ſome green vegetable food for their ſheep and cattle; whereas, by the aſſiſtance of my turnip-rooted cabbages, I have abundance of the beſt and moſt nutritive food that can be found them." He then proceeds to recommend their culture "for the ſupport of almoſt all live ſtock for the three laſt weeks of April, or firſt week of May, when the graſs ſhoots late."

In the 4th volume of the Tranſactions of the Society for encouraging Arts, Mr Robins, who received a premium for raiſing the greateſt quantity of this plant, informs us, that the ſoil on which it grew was a *ſtone braiſh*, inclining to ſand, not worth more than 10s. per acre; the preparation the ſame as for turnips. The manure was a compoſt of earth and dung, which he finds to anſwer better than dung. The ſeed was ſown about the beginning of April on a clean ſpot of ground; and he commonly uſes an old paſture where the ſheep-fold has been in the winter, after taking away the dung, and digging it very ſhallow; "as the roots of the young plants (ſays he) might ſoon reach the dung or ſalts, which muſt conſequently be left, in order to force them out of the fly's way." Theſe inſects, our author obſerves, are extremely fond of the

turnip-

turnip-rooted cabbage; much more ſo, he believes, than of common turnips. About the middle of June they ſhould be planted out upon one-bout ridges raiſed by a double plough made for the purpoſe. Seven thouſand plants are ſufficient for one acre; but if only ſix are uſed, the roots will be the larger. Culture of particular Plants.

To determine how many ſheep might be kept upon an acre of turnip-rooted cabbage, our author ſhut up 200 ewes with their lambs upon a piece of poor paſture land of no great extent; the whole not exceeding ten acres. One ton was found ſufficient for keeping them in ſufficient health for a day. On giving them a larger piece of ground to run over, though it had been eaten all winter and late in the ſpring, yet, with this trifling aſſiſtance, 13 tons of turnip-cabbage were made to ſerve 18 days; at the end of which the ewes and lambs were found very much improved, which could not have been expected from four acres of turnips in the month of April, the time that theſe were fed. Number of ſheep fed by an acre of turnip-rooted cabbages.

From ſome trials made on the turnip-rooted cabbage at Cullen Houſe in the north of Scotland, it appears that the plant is adapted to the climate of every part of our iſland. The firſt trial was made in the year 1784. The ſeeds were ſown about the middle of March in garden ground properly prepared. The cabbages were tranſplanted about the middle of March that year into a dry light ſoil, well cleaned and dunged with rotten cow-dung, in rows three feet diſtant from each other, and at the diſtance of 20 inches in the rows. They were kept very clean, and the earth was hoed up to the roots of the plants; by which means they were probably prevented from attaining the hardneſs they would otherwiſe have arrived at; Experiments at Cullen-houſe.

though,

Culture of particular Plants.

though, after all, it was neceſſary to cut the roots in two before the ſheep could eat them. When thus cut, the animals ate them greedily, and even preferred them to every other food. The roots continued good for at leaſt a month after the common turnips were unfit for uſe: ſome of them weighed from eight to ten pounds, and a few of them more. Other trials have ſince been made; and it now appears that the plant will thrive very well with the ordinary culture of turnips in the open fields, and in the uſual manner of ſowing broad-caſt. From a comparative trial made by the earl of Fife upon this root with ſome others, the quantities produced upon 100 ſquare yards of ground were as follows:

	ſtone.	lb.
Common turnips - -	92	4
Turnip-rooted cabbage -	88	0
Carrots - - -	95	0
Root of ſcarcity - -	77	0

The turnip-rooted cabbage was planted in lines 26 inches aſunder; the common turnips ſown broad-caſt, and hand-weeded, ſo that they came up very thick, being not more than three or four inches aſunder when full grown. Two cows were fed for ſix weeks with the turnips, two with the turnip-rooted cabbage, and two with the root of ſcarcity for an equal time: the two fed with turnips gave moſt milk, and thoſe with the root of ſcarcity the leaſt. His lordſhip obſerves, however, that carrots thrive better on his farm than any other crop: that his horſes had been fed on them at the rate of two pecks a-day, with no corn, and little more than half the uſual quantity of hay. "They have kept

kept at work every day from ſeven to eight hours, and were never in better order." Culture of particular Plants.

2. Swedish Turnip, or Roota Baga.

The roota baga, or Swediſh turnip, is a plant from which great expectations have been formed. It is ſaid to be hardier than the common turnip, and of greater ſweetneſs and ſolidity. It alſo preſerves its freſhneſs and ſucculence till a very late period of its growth, even after it has produced ſeed; on account of which property it has been recommended to the notice of farmers as an excellent kind of ſucculent food for domeſtic animals in the ſpring of the year, when common turnips and moſt other winter crops have failed, and before graſs has got up to furniſh an abundant bite for feeding beaſts. This peculiarity, ſo valuable, yet ſo ſingular as to have led many at firſt to doubt the fact, ſeems to be ſufficiently aſcertained by experiment. Dr J. Anderſon * in particular informs us, that it "begins to ſend out its flower-ſtems in the ſpring, nearly about the ſame time with the common turnip; but that the root, in conſequence of that change of ſtate, ſuffers very little alteration. I continued to uſe theſe turnips at my table every day till towards the middle of May; and had I never gone into the garden myſelf, I ſhould not even then have ſuſpected, from the taſte or appearance of the bulb itſelf, that it had been ſhot at all. The ſtems, however, at the ſeaſon I gave over uſing them, were from four to five feet high, and in full flower. I ſhould have continued the experiment longer, Of the roota baga.

* The *Bee*, vol. iii. p. 291.

Culture of particular Plants.

had not the quantity I had left for that purpoſe been exhauſted, and a few only left for ſeed.

"This experiment, however, fully proves, that this kind of turnip may be employed as a ſucculent food for cattle till the middle of May at leaſt, in an ordinary year; and I have not the ſmalleſt doubt but it will continue perfectly good for that purpoſe till the end of May in any ſeaſon; at which time graſs and other ſpring crops can eaſily be had for bringing beaſts forward in fleſh. I can therefore, without heſitation, recommend this plant to the farmer as a moſt valuable ſpring feeding for cattle and ſheep; and for this purpoſe, I think no wiſe farmer ſhould be without a proportion of this kind of turnip to ſucceed the other ſorts after they fail. The profitable method of conſuming it, where it is to be kept very late, is, I am convinced, to cut off the tops with a ſcythe or ſickle when from one foot to eighteen inches high, to induce it to ſend out freſh ſtems, that will continue ſoft and ſucculent to the end; whereas, without this proceſs, the ſtems would become ſticky and uſeleſs.

"I cannot, however, recommend this kind of turnip, from what I have yet ſeen, as a general crop; becauſe I think it probable, that unleſs in particular circumſtances, the common field turnips grow to a much larger ſize, and afford upon the whole a more weighty crop. Theſe, therefore, ſhould ſtill continue to be cultivated for winter uſe, the other being reſerved only for ſpring conſumption.

"Experiments are ſtill wanting to aſcertain with certainty the peculiar ſoil and culture that beſt agree with this plant; but from the few obſervations I have hitherto had an opportunity of making upon it, it ſeems

to me probable, that it thrives better, and grows to a larger ſize on damp clayey ſoil, than on light ſandy land. But I would not wiſh to be underſtood as here ſpeaking poſitively; I merely throw it out as a hint for future obſervation: on ſpongy ſoil it proſpers. Culture of particular Plants.

"Though the uſes of this as a garden plant are of much ſmaller conſequence than thoſe above ſpecified, it may not be improper to remark, that its leaves form a very ſweet kind of greens at any time; and merely for the ſake of the experiment, I cauſed ſome of theſe to be picked off the ſtems of the plants coming to ſeed, on the 4th of June, the king's birth-day, which, on being readied, were found perfectly ſweet, without the ſmalleſt tendency to bitterneſs, which moſt, if not all, other kinds of greens that have been hitherto cultivated are known to acquire after their ſtems are conſiderably advanced; no family, therefore, can ever be at a loſs for greens when they have any of this plant in ſeed.

"A root of this kind of turnip was taken up this day (June 15.); the ſeed-ſtalks were firm and woody, the pods full formed, and in ſome of them the ſeeds were nearly ripe. The root, however, was as ſoft and ſucculent as at any former period of its growth; nor was the ſkin, as I expected, hard or woody. It was made ready and brought to the table: ſome perſons there thought the taſte as good, if not better, than at any former period of its growth; but I myſelf, perhaps through prejudice, thought it had not quite ſo high a relish as in winter: At any rate, however, there can be no doubt, that if ever it could be neceſſary, it might, even now, be employed very properly as a feeding for cattle."

Culture of particular Plants.

Culture of the roota baga in Nottinghamſhire.

This vegetable, from its obvious utility, is gradually coming to be much uſed in various quarters of the iſland. In the Agricultural Survey of Nottinghamſhire, the following deſcription of the modes in which it has been ſucceſsfully cultivated, is well worthy of attention. "The roota baga, or Swediſh turnip, is now cultivated by a few farmers in this diſtrict. It appears to be ſuperior to the common turnip in many reſpects, particularly in hardineſs, as it ſtood the laſt ſevere winter without the leaſt injury. It is eaten with greedineſs by all animals, from the horſe to the ſwine. Sheep prefer it to all others; but the material advantage that has been made of it, is the ſubſtituting it for corn in the food of draught horſes; in which it has been found to anſwer the wiſh of every perſon who has yet tried it. The turnips are put into a tub or barrel, and cut ſmall with an inſtrument like a hoe, with the blade put perpendicularly into the ſhaft; a man will cut in one hour as much as ſix horſes can eat in twenty-four. The tops and bottoms are previouſly cut off and given to the pigs. Horſes that are hard worked, look full as well when fed with this turnip and very little hay, as they formerly did when very high fed with corn. The Swediſh turnip ſhould be ſowed early, from the 15th of May to the 10th of June."—The following information on the culture of the roota baga, is given in the ſame Survey upon the authority of J. Daiken, Eſq. of Nottingham.

Mr Daiken, about the 10th of May 1794, ſowed about four acres with the ſeed of roota baga, about 2 lbs. per acre, on good ſand land, worth 20s. an acre, manured as for turnips, and having been plough[illegible] four or five times; the reſt of the field, to the amount of

of nine acres in all, with common turnip and turnip-rooted cabbage, all broad-caſt. They were not tranſplanted, but hoed out nine inches aſunder, at three hoeings, at 7s. 6d. an acre; no other culture. In November, began to uſe them for horſes, giving at firſt clover and rye-graſs hay, oats and beans; but finding that the horſes did well upon them, left off all corn, and continued them on hay and the roots only; fifteen were thus fed for about two months, were conſtantly hard worked, and preſerved themſelves in very good condition. Mr Daiken is ſo well convinced, that in this application they were worth 30l. an acre, that he would in future, if he could not get them otherwiſe, rather give that ſum per acre for one or two acres, than not have them for this uſe. They loſt their leaves entirely when the froſt ſet in; but the roots were not the leaſt affected, though the common turnips in the ſame field were totally deſtroyed. Paſſengers paſſing through the field, cut holes in them, which did not let the froſt injure them; nor were thoſe hurt which were damaged by cattle biting them. Some came to the weight of 16lbs. and Mr Daiken thinks the average of the crop 8lbs. and much to exceed in tonnage per acre common turnips. Culture of particular Plants.

Mr Daiken gave them alſo to hogs, cattle, and ſheep. They are excellent for hogs; and ſheep being let into the field before the common turnips were deſtroyed, gave ſo decided a preference to the roota baga, that they would not ſettle on the common turnips while the others were to be had.

The method of giving them to horſes is to cut off the tap-root, to waſh them, and to cut them roughly with a perpendicular hoe, and then give them directly,

Culture of particular Plants.

without keeping them to dry. The horſes ate them with avidity, and ſeemed even to prefer them to corn. Their qualities appear to be ſingular, as they bind horſes inſtead of relaxing them as other roots do. One mare was kept entirely upon them and ſtraw, worked every day, did well, and never looked better; this mare was more bound by them than the reſt. They have a ſtrong effect upon making the coats fine; and one or two affected by the greaſe, were cured by them, as they act as a ſtrong diuretic. In this mode of application, one acre maintained fifteen about two months: and Mr Daiken is ſo well convinced of the utility of the plant, as well as many of his neighbours, that he intends, and they alſo, to increaſe the cultivation much.

Mr Daiken ſuſpects there are two ſorts of the roota baga, becauſe ſome, upon cutting, are white within, but in general yellow; otherwiſe of the ſame external appearance. The yellow is the beſt.

Mr Robertſon of Midlothian has remarked * that "the Swediſh turnip is perhaps not ſo beneficial in ſome reſpects as the common turnip; but as it admits of being tranſplanted with advantage, it is ſurely an object of attention to the turnip-farmers, as by the means of it they can fill up any vacancies in the drills of the common kind with very little expence, which is hardly practicable by any other means. Even where the turnip fails altogether, as by the fly or ſlugs, the crop can be more readily renewed from a ſeed-bed of roota-baga,

---

* *Annals of Agriculture*, vol. xxvi.

than from re-ſowing the field, which ſeldom comes to much good." Culture of particular Plants.

The following communication, procured by favour of the honourable Baron Cockburn, ſets the Swediſh turnip in a ſtill more favourable light.

"This plant is the beſt calculated of any for a northern climate, as it ſtands froſt well; keeps wonderfully when headed with ſtraw, built in ſtooks, which becomes in a great meaſure neceſſary, as hares reſort to it from all quarters, and will touch no other root while any of it remains." It eats as well after it is ſhot, and ſheds its ſeed, as it does before. I ſaw ſome at the duke of Buccleugh's farm, which, with ſeveral others, had been lifted and ſtacked the firſt week in November, at Dalkeith, after the winterers had been turned to graſs, one root of which I carried home, and found it, when boiled, eat as well as it would have done in the month of October.

"Cattle are much fonder of them than turnips, inſomuch, that, when put into a ſtraw yard together, the turnips are never touched until the other is entirely eaten up: nay, after having been accuſtomed for ſome time to the Swediſh plant, they have been found to refuſe turnips for many hours; and even when compelled by hunger, to take them with a ſeeming reluctance. The ſuperior nutritious quality of the plant is pretty well aſcertained from this fact, that, upon a compariſon of a number of ſquare inches of a ſingle root againſt the ſame of field turnips, the weight was a third more; the cattle fed upon it, put up at the ſame time with others upon turnips, advanced more in a month than the others did in ſix weeks. Upon land prepared for turnips, the proper ſeaſon for ſowing it is about

Culture of particular Plants.

the 10th of May, and not much later. It has been tried in February, when early garden turnips are ſown, but it always failed, growing to the ſtalk only without any root; when ſown after May it ſeldom came to any tolerable ſize. Hares do not much take to it until the end of October, when the froſt commonly begins; but, as it can then be ſtacked, this objection is removed; and likewiſe the trouble attending the ſupply of cattle, during a ſtorm, with turnips, which will not ſuffer to be kept long after being taken out of the ground. The ſhaws of this plant, when carefully ſtripped, are found to be an excellent kitchen green, and a good ſubſtitute for ſpinach."

Dr Campbell of Lancaſter *, ſays of ſome Swediſh turnips ſown by him in 1798, that "they attained a good ſize, and were not at all affected by the ſevere froſt of that winter, which deſtroyed the general crop of other turnips. The thermometer fell on the 27th of December of that year to 12 degrees of Fahrenheit, which is an intenſity of cold that the common turnip cannot withſtand. It is certainly an acquiſition of no common magnitude to have a winter food for cattle, which is inacceſſible to froſt, ſo that it can at all times be taken freſh from the field where it grows, (for however the ground be frozen, they may be got up by means of a pick-axe), and which continues in perfection through the whole ſpring of the year, ſo late as the month of May, and until graſs ſpring again. Theſe properties of the Swediſh turnip point out the propriety of of its conſtituting a part of the winter food, at leaſt, in every

* *Communications to the Board of Agriculture*, vol. iii.

every perſon who has a ſtock of cattle. It ſeldom happens that any froſt ſo ſevere as materially to injure the turnips occurs before Chriſtmas; and if the common ſorts were to be reſorted to until about that period, and the Swediſh for the remainder of the ſeaſon, we ſhould have ſo certain a ſupply as to bid defiance to any inclemency of weather. Culture of particular Plants.

"There is one circumſtance attending the cultivation of the Swediſh turnips which deſerves attention; which is, that they will not come to a good ſize, except with a large quantity of manure (ſtable dung.) I have underſtood, that they have been tried in many places in this neighbourhood, and fallen into diſrepute from their not acquiring any greater ſize than a carrot, which has been owing to the circumſtance alluded to, as I have myſelf found to be the caſe, where the full quantity of dung had not been uſed. It appears too, that from this circumſtance the drill ſyſtem is particularly ſuited to the cultivation and growth of this ſpecies of turnip, as the roots are ſo certain to meet with dung beneath. Thoſe I have raiſed, particularly the preſent year, are of a good ſize, as large as eight or nine pounds weight. They are ſo much more ſolid than the common turnips, that on weighing a load of three Wincheſter buſhels of each, the one weighed 180 pounds, whilſt the other was 264 pounds weight.

"It is recommended to ſow the ſeed in May, in order to give this ſpecies of turnip an opportunity of acquiring its full ſize. Although circumſtances have hitherto prevented [illegible] from being ſown earlier than the firſt week in June, they have acquired a very tolerable magnitude; but perhaps it might have been better had it been done at an earlier period.

"For

Culture of particular Plants.

"For the table they are certainly the best turnips that have been yet introduced; and, where they are known, bear a decided preference in the market.

"I am ſorry to obſerve an inferior variety of the turnip becoming more general for theſe two laſt years; it is not diſtinguiſhable whilſt growing, but is upon pulling. The kind is white, whilſt the [illegible]aga is yellow; this puts out large tap-roots, which renders it unſightly and leſs marketable, whilſt the other is round and compact as to its roots. It is alſo leſs palatable for the table. Great attention will be neceſſary on the part of thoſe who raiſe the ſeed to get rid of this ſpecies, otherwiſe this turnip may get into unmerited diſrepute."

3. Turnip Cabbage.

This plant is as yet but little known. The ſeed is ſaid to have been brought from the Cape of Good Hope by Mr Haſtings, where it is very common, as well as in Holland. It has alſo had an exiſtence in Britain for many years, though not generally known. It has a much greater affinity to the cabbage than to the turnip; and is very hardy, bearing the winter as well, if not better, than common brocoli, and may therefore be conſidered as a valuable acquiſition to the kitchen garden as well as for cattle. The beſt time for ſowing it for the garden is the end of May or beginning of June, though none of the plants have ever been obſerved to run to ſeed, though ſown ever ſo early. Even though ſown in Auguſt, at the [illegible] ſeaſon, the greater part ſtood throughout the following ſummer, and did not ſeed till the ſecond ſpring. The plants require nearly the ſame management with brocoli;

Method of cultivation

brocoli, as to diſtance, tranſplanting, &c. and are uſually moſt eſteemed when young, and about the ſize of a moderate garden turnip; thoſe ſown in June will continue all winter. The bulb muſt be ſtripped clean of its thick fibrous rind; after which it may be uſed as a common turnip. The crown or ſprout is very good, but eſpecially in the ſpring, when they begin to run to ſeed. Mr Broughton, from whoſe account in the Bath Papers, vol. v. this article is taken, thinks that the turnip-cabbage is more nutritious than the common turnip. The largeſt bulb he meaſured was 23 inches circumference; but the thickneſs of the rind is ſo great, that ſome farmers imagined that the bulb would be too hard for ſheep. The objection, however, was obviated by Mr Broughton, who gave ſome of the oldeſt and tougheſt bulbs to his ſheep, and found that they not only penetrated through the rind, but even devoured the greateſt part of it. Culture of particular Plants.

4. Cabbage.

The cabbage has been recommended by long experience as an excellent food for cattle. Its uſes as a part of human food are alſo well known. It is therefore an intereſting article in huſbandry. It is eaſily raiſed, is ſubject to few diſeaſes, reſiſts froſts more than turnip, is palatable to cattle, and ſooner fills them than turnip, carrot, or potatoes. Culture of cabbage.

Mr Young remarks * that "the culture of cabbages for cattle, is one of the moſt important objects in [illegible] agriculture; without which, large ſtocks of cattle

* *Travels*, vol. ii.

Culture of particular Plants.

cattle or ſheep are not to be kept on ſoils improper for turnips. They are, in every reſpect but one, preferable to that root; the only inferiority is, that of cabbages demanding dung on all ſoils, whereas good land will yield turnips without manuring."

Seaſon of planting.

The ſeaſon for ſetting cabbage depends on the uſe it is intended for. If intended for feeding in November, December, and January, plants procured from ſeed ſown the end of July the preceding year muſt be ſet in March or April. If intended for feeding in March, April, and May, the plants muſt be ſet the firſt week of the preceding July, from ſeed ſown in the end of February or beginning of March the ſame year. The late ſetting of the plants retards their growth; by which means they have a vigorous growth the following ſpring. And this crop makes an important link in the chain that connects winter and ſummer green food.

Advantage of repeated tranſplanting.

Mr Vancouver ſuggeſts that a ſingle tranſplanting of cabbages is not ſufficient for their proper cultivation. "A few words, ſays he *, with regard to the culture of cabbages will be ſufficient to point out the neceſſity of an intermediate tranſplanting of the young plants between the ſeed-bed and the field; for when the plants are drawn from the ſeed-bed, and put directly into the field, they are found to be out of all proportion, tall, ſlender, and altogether unfit for their new and expoſed ſituation; to this muſt be added, a long tap-root without lateral fibres; and which neceſſarily undergoes ſeveral twiſts and doubles in the hole by the operation of planting; here the plant languiſhes till its lateral

are

* *Annals of Agriculture*, vol. xxv.

are formed, which it is gradually doing as the tap-root decays. As the ſeaſon may be more or leſs kind, the plant may droop for a while; but it too often happens, and that in deſpite of the moſt unwearied induſtry, that the plant loſes its life and its tap-root together; hence ariſes the neceſſity of ſuch frequent replantings, and herein lurks the cauſe of that univerſal languor which ſo long prevails through all the fields of cabbages that are thus tranſplanted into the field directly from the ſeed-bed. It is the nature of the cabbage to loſe its tap-root upon its firſt removal, and in its place is put forth a bunch of lateral roots juſt below the ſurface of the ground. The ſtem of the plant then begins to ſtrengthen, and its leaves to ſpread. This change in the root being completed from an intermediate tranſplanting, the young plant will be the better able to combat the hardſhips of its new ſituation in the field; for being already furniſhed with lateral roots, its nouriſhment from the ground will be immediate and certain; it will flouriſh and come to an early maturity, rather than languiſh for a while, and then periſh as thouſands now do; or creep ſlowly on, till, late in the ſeaſon, they arrive at a ſtunted and unprofitable end. In proportion as the lateral roots increaſe and collect nouriſhment, the plant heads and flouriſhes; nor would the kindlieſt plant, upon the moſt favoured ſoil, cabbage, or even come to perfection, were it not by ſome means or other deprived of its tap-root. The expence therefore of an intermediate tranſplanting between the ſeed-bed and the field, to thoſe who are deſirous of excelling in the culture of cabbages, can bear no proportion whatſoever to the labour, expence, and diſappointment, that

Culture of particular Plants.

Culture of particular Plants.

that muſt for ever await the want of ſo material a training and preparation of the infant plant."

Prepara-tion of the foil.

And now to prepare a field for cabbage. Where the plants are to be ſet in March, the field muſt be made up after harveſt in ridges three feet wide. In that form let it lie all winter, to be mellowed with air and froſt. In March, take the firſt opportunity, between wet and dry, to lay dung in the furrow. Cover the dung with a plough, which will convert the furrow into a crown, and conſequently the crown into a furrow. Set the plants upon the dung, diſtant from each other three feet. Plant them ſo as to make a ſtraight line croſs the ridges, as well as along the furrows, to which a gardeners line ſtretched perpendicularly croſs the furrows will be requiſite. This will ſet each plant at the diſtance preciſely of three feet from the plants that ſurround it. The purpoſe of this accuracy is to give opportunity for ploughing not only along the ridges, but croſs them. This mode is attended with three ſignal advantages: it ſaves hand-hoeing, it is a more complete dreſſing to the ſoil, and it lays earth neatly round every plant.

If the ſoil be deep and compoſed of good earth, a trench-ploughing after the preceding crop will not be amiſs; in which caſe, the time for dividing the field into three-feet ridges, as above, ought to be immediately before the dunging for the plants.

If weeds happen to riſe ſo cloſe to the plants as not to be reached by the plough, it will require very little labour to deſtroy them with a hand-hoe.

Unleſs the ſoil be much infeſted with annuals, twice ploughing after the plants are ſet will be a ſufficient dreſſing. The firſt removes the earth from the plants;

tl.

the next, at the diſtance of a month or ſo, lays it back. Culture of particular Plants.

Where the plants are to be ſet in July, the field muſt be ribbed as directed for barley. It ought to having a light ploughing in June before the planting, in order to looſen the ſoil, but not ſo as to bury the ſurface-earth; after which the three-feet ridges muſt be formed, and the other particulars carried on as directed above with reſpect to plants that are to be ſet in March.

In a paper already quoted from thoſe of the Bath Society, Scots cabbages are compared, as to their utility in feeding cattle, with turnips, turnip-rooted cabbage, and carrots. In this trial the cabbages ſtand next in value to the carrots; and they are recommended as not liable to be affected by froſt, if they be of the true flat-topped firm kind. Fifty-four tons have been raiſed upon an acre of ground not worth more than 12 ſhillings. Quantity raiſed on an acre, &c. There is likewiſe an advantage attending the feeding of cattle with cabbages, viz. that their dung is more in proportion than when fed with turnips or with hay; the former going off more by urine, and the latter having too little moiſture. They alſo impoveriſh the ground much leſs than grain. Mr Billingſley accounts 46 tons per acre a greater crop than he ever read of: but Mr Vagg, in the 4th volume of Bath Papers, gives an account of a crop for which he received a premium from the Society, which was much ſuperior to that of Mr Billingſley. Its extent was 12 acres; the produce of the worſt was 42, and of the beſt 68 tons. They were manured with a compoſt of lime, weeds, and earth, that lay under the hedges round the field, and a layer of dung, all mixed

and

Culture of particular Plants.

and turned together. About 25 cart loads of this were ſpread upon an acre with the uſual ploughing given to a common ſummer fallow; but for this, he ſays, "admitting ſuch a crop to exhauſt the manure in ſome degree by its growth, an ample reſtoration will be made by its refuſe ploughed in, and by the ſtirring and cleaning of the ground." The whole expence of an acre, excluſive of the rent, according to Mr Vagg's calculation, amounts to 1l. 14s. 1d. only four ounces of ſeed being requiſite for an acre. The 12 acres, producing as above mentioned, would feed 45 oxen, and upwards of 60 ſheep, for three months; improving them as much as the graſs in the beſt months of the year, May, June, and July. He recommends ſowing the ſeed about the middle of Auguſt, and tranſplanting the young cabbages where they may be ſheltered from the froſt; and to the neglect of this he aſcribes the partial failure, or at leaſt inferiority, of one part of his ground in the crop juſt mentioned, the young plants not being removed till near midſummer, and then in ſo dry a time, that they were almoſt ſcorched up.

Of watering cabbages.

In the Farmer's Magazine, vol. ii. p. 217. we have ſeveral pertinent remarks upon the culture of this uſeful plant, particularly with regard to watering. "It is a rule (ſays this correſpondent) never to water the plants, let the ſeaſon be as dry as it may; inſiſting that it is entirely uſeleſs. If the land is in fine tilth and well dunged, this may be right, as the expence muſt be conſiderable; but it is probable, in very dry ſeaſons, when the new ſet plants have nothing but a burning ſun on them, that watering would ſave vaſt numbers, and might very well anſwer the expence, if

a pond is near, and the work done with a water-cart." He takes notice alſo of another uſe of cabbages, which has not met with the attention it merits, viz. the planting of lands where turnips have failed. A late ſown crop of theſe ſeldom turns to any account; but cabbages planted on the ground without any ploughing would prove very beneficial for ſheep late in the ſpring; in all probability (unleſs on light, ſandy, or limeſtone ſoils) of greater value than the turnips, had they ſucceeded. Culture of particular Plants.

Mr Marſhal obſerves, that in the midland diſtrict, a valuable ſort of large green cabbage "is propagated, if not raiſed, by Mr Bakewell, who is not more celebrated for his breed of rams than for his breed of cabbages. Great care is obſerved here in raiſing the ſeed, being careful to ſuffer no other variety of the braſſica tribe to blow near ſeed cabbages; by which means they are kept true to their kind. To this end, it is ſaid that ſome plant them in a piece of wheat; a good method, provided the ſeed in that ſituation can be preſerved from birds." Cabbages cultivated in the midland diſtrict.

The advantage of having large cabbages is that of being able to plant them wide enough from each other, to admit of their being cleaned with the plough, and yet to afford a full crop. The proper diſtance depends in ſome meaſure on the natural ſize of the ſpecies and the ſtrength of the ſoil; the thinner they ſtand, the larger they will grow: but our author is of opinion that cabbages, as well as turnips, are frequently ſet out too thin. Four feet by two and a half, according to Mr Marſhal, are a full diſtance for large cabbages on a rich ſoil. Diſtance at which they ought to be placed.

We think it of importance to take notice of the

Culture of particular Plants.

Method of tranſplanting and earthing them.

following mode of tranſplanting full-grown cabbages, or earthing them, as being conſiſtent with the beſt mode of practice, and coming from the moſt reſpectable practical authority, Mr George Cully of Fenton. "We plant the cabbages, ſays he *, not only in right lines but equidiſtant every way, ſo that we can plough between the rows, both long-ways and croſs over; which, by looſening the earth ſo effectually on all ſides, very much promotes their growth. But the matter I wiſhed to inform you of, is the taking them up by the roots in the autumn whenever they have completed their growth, and putting them into the neareſt ſtubble field you have, where a plough is ready to draw a ſtraight furrow in the moſt convenient place; and at twenty yards diſtance, more or leſs, the ploughman makes another furrow parallel to the firſt. The cabbages are now turned out of the carts as conveniently as may be for a ſufficient number of women to lay them along theſe furrows as cloſe one to another as poſſible. The ploughman begins again where he firſt ſtarted, and turns a large furrow upon the cabbages, which is trodden down and righted by one, two, or more, as occaſion requires, with each a ſpade in his hand, to aſſiſt where the plough has by chance or accident not thrown earth enough. Thus the work goes on till all is finiſhed.

"We think we derive two advantages by the above proceſs. In the firſt place, the cabbages keep ſufficiently well through the winter in their new ſituation, while they do not draw or exhauſt the land ſo much where they were growing: and, ſecondly, that land is at

* *Annals of Agriculture*, vol. xv.

at liberty to be ſown with wheat as ſoon as cleared of the cabbages; which grain, in general, anſwers well after that green crop." Culture of particular Plants.

Cabbages and greens in general are apt to be infeſted by caterpillars. They may uſually however be protected againſt thoſe vermin by pulling off the large undermoſt leaves, which may be given to cows in the month of Auguſt, or when the common white butterflies begin to appear in numbers. Theſe butterflies lay their eggs, which produce the cabbage caterpillar, on the under ſide of the largeſt leaves of the cabbage plants. There is alſo ſaid to be another remedy. It conſiſts of ſowing beans among the cabbages, which will greatly prevent the breeding of theſe worms; for it is ſaid that the butterflies have an antipathy to the flavour of beans. How protected from caterpillars.

Mr Young * takes notice of his having ſeen in an agricultural tour through Suſſex another mode of accompliſhing this object, which was uſed by a farmer, whoſe practice in other points of view appears reſpectable. "Cabbages he (Mr Millward) finds to be excellent food for his fat ſheep; he ſows the drum-head cabbage about the middle of February in the warmeſt part of a field; and as they ſpring up he ſprinkles aſhes over the ground to deſtroy the fly. During the ſummer he plants them out three feet ſquare, upon land neither ſtiff nor light; they are afterwards horſe-hoed and landed up. If caterpillars infeſt the land he ſtrews tarred rags over the fields, or hangs the rags dipped in tar upon ſticks a foot high, early in the ſummer, to prevent the butterfly from ſettling on the plant and engendering the caterpillar.

* *Annals of Agriculture*, vol. xxii.

Culture of particular Plants.

terpillar. Cabbages will laſt from September to February."

5. Coleworts, or Open Kail.

Theſe are in Scotland univerſally cultivated in every cottager's garden, (hence called the *kail-yard.*) They have been known to thrive on the ſame ſpot for ages, owing perhaps to their perpetual verdure, which enables them conſtantly to cover and ſhelter, and thereby to ameliorate the ſoil. In the fields they flouriſh moſt luxuriantly, far ſurpaſſing cabbages, requiring much leſs manure and almoſt no attention. They are exceedingly leſs liable to be hurt by froſt, and cattle eat them with great avidity. The compiler of theſe remarks has ſeen them growing on the north-eaſt ſummit of Corſtorphine hill near Edinburgh, without culture: the ſeed ripening, and young plants riſing amidſt fragments of broken rock, with ſcarcely a ſhadow of ſoil to nouriſh them. There indeed appears from experience to be no vegetable more congenial to our ſoil and climate than this, and it is not a little wonderful that it has not hitherto come into more extenſive cultivation. It is an excellent ſmothering crop; it is fit to be uſed for feeding cattle both during ſummer and winter; during the former of theſe periods without injury to its growth, immenſe quantities of the open leaves may ſafely be removed from it for that purpoſe, and ſome of the ſpecies of it (of which there are many) are ſo hardy that no intenſity of froſt is injurious to them. It is particularly valuable for cows that are intended to give milk during the winter, and from its ſtanding aloft it can without much difficulty be cut even in time of ſnow.

The

The mode of cultivation is ſimilar to that adopted for cabbages, excepting as already mentioned, that leſs manure and leſs care are neceſſary. Mr Young obſerved the cultivation of them in Flanders, and mentions it in theſe terms: * "From *Orchies to Lille*—The kale, called here *choux de vache*, is common through this country; it never cabbages, but yields a large produce of looſe reddiſh leaves which the farmers give to their cows. The ſeed is ſown in April, and they are tranſplanted in June or July, on to well-dunged land in rows, generally two feet by one foot; I ſaw ſome fields of them in which they were planted at greater diſtances. They are kept clean by hoeing. They are reckoned excellent food for cows; and the butter made from them is good, but not equal to that from carrots." Culture of particular Plants.

6. The BEET, or ROOT of SCARCITY.

The *racine de diſette*, or root of ſcarcity (*Betacicla*), delights in a rich loamy land well dunged. It is directed to be ſown in rows, or broad-caſt, and as ſoon as the plants are of the ſize of a gooſe quill, to be tranſplanted in rows of 18 inches diſtance, and 18 inches apart one plant from the other: care muſt be taken in the ſowing, to ſow very thin, and to cover the ſeed, which lies in the ground about a month, an inch only. In tranſplanting, the root is not to be ſhortened, but the leaves cut at the top; the plant is then to be planted with a ſetting ſtick, ſo that the upper part of the root ſhall appear about half an inch out of the ground; this laſt precaution is very neceſſary to be attended to. Culture of the root of ſcarcity.

* *Travels*, vol ii.

Culture of particular Plants.

Theſe plants will ſtrike root in twenty-four hours, and a man a little accuſtomed to planting will plant with eaſe 1800 or 2000 a-day. In the ſeed-bed, the plants, like all others, muſt be kept clear of weeds: when they are planted out, after once hoeing, they will take care of themſelves, and ſuffocate every kind of weed near them.

The beſt time to ſow the ſeed is from the beginning of March to the middle of April: it is, however, adviſed to continue ſowing every month until the beginning of July, in order to have a ſucceſſion of plants. Both leaves and roots have been extolled as excellent both for man and beaſt. This plant is ſaid not to be liable, like the turnip, to be deſtroyed by inſects; for no inſect touches it: nor is it affected by exceſſive drought, or the changes of ſeaſons. Horned cattle, horſes, pigs, and poultry, are exceedingly fond of it when cut ſmall. The leaves may be gathered every 12 or 15 days; they are from 30 to 40 inches long, by 22 to 25 inches broad. This plant is excellent for milch cows, when given to them in proper proportions, as it adds much to the quality as well as quantity of their milk; but care muſt be taken to proportion the leaves with their green food, otherwiſe it would abate the milk, and fatten them too much, it being of ſo exceeding a fattening quality. To put all theſe properties beyond doubt, however, further experiments are wanting.

We ſhall afterwards have occaſion to conſider both the qualities and the mode of cultivating this plant, when we come to treat of the cultivation of ſuch vegetables, as are more properly articles of commerce.

SECT.

SECT. IV.

CULTURE OF GRASS.

Importance of the culture of grafs.

The culture of grafs is at once a difficult and an important branch of the occupation or art of the husbandman. It is difficult; becauſe the principles upon which it reſts are not yet well underſtood, or are only beginning to be ſo; and it is important, both on account of its direct value in feeding cattle, when well cultivated, and on account of its indirect worth, conſidered as a preparation for raiſing grain. According to the obſervation of Mr Young, he who has graſs can at all times have corn; whereas, the reverſe of the propoſition is by no means true, on account of the preparation neceſſary to the production of valuable graſs. A cloſe and ſound turf is the beſt and the richeſt manure that has yet been diſcovered in nature, and when lands covered by it are broken up by the plough, they never fail for a time to produce valuable crops, whether of grain or of roots. A nation therefore which poſſeſſes a conſiderable quantity of excellent graſs grounds, may be ſaid to have bread, and conſequently to have riches, laid up as in a ſtorehouſe, from which it can be drawn at pleaſure. Practical huſbandmen alſo frequently prefer paſture to arable lands, on account of the ſmall degree of labour or hazard that attends it, and on account of the opportunity which it affords of laying out a great capital, with a reaſonable proſpect of profit. Men of property alſo are often induced to give it a pre-

Culture of Graſs.

ference, on account of the good condition in which it preſerves their lands, the wealth of the tenants, which it procures for them, and the conſequent eaſe with which a large eſtate may be managed.

Wherein hay and paſture differ.

In the culture of graſs an important diſtinction ought never to be loſt ſight of, between graſs intended to be cut for hay, and that which is meant to be conſumed by cattle upon the ground, which laſt is moſt properly paſture land. When a crop of hay is reaped, the ſoil is exhauſted, in a certain degree, without any thing being reſtored to it; which is not the caſe when the cattle feed upon the ground. It ought to be obſerved, however, that a hay crop exhauſts the ſoil very ſlightly, if it is cut extremely green, and before the graſs plants have time to ripen their ſeeds. The degree in which the ſoil is exhauſted, is found by experience to be proportioned to the maturity of the ſeeds of the graſſes. Where hay crops, therefore, are raiſed, it is always neceſſary to dreſs the fields from time to time with manure.

Independent of the difference between paſturage and hay crops reſulting from the neceſſity of manure, it is to be remarked, that graſs, which for ſome time has been cut for hay, is thereby rendered leſs fit to be uſed for paſturage;* while on the contrary, when the land is paſtured for ſome years, it becomes unfit to produce a good crop of hay: this ariſes from the pliable nature of the graſs plants, and the habits which they are capable of acquiring. The graſs plants propagate in two ways, by ſeed and by root. When they are allowed to ſtand for hay, and conſequently to riſe to maturity, nature ſeems to intruſt the propagation of the different ſpecies to the ſeed which they produce. They grow

Graſs how propagated.

up

up with ſtrong ſtems, few in number, and the ſoil on which they reſt retains a conſiderable degree of openneſs; whereas, when a field of graſs is kept low by being conſtantly, and rather ſeverely paſtured by cattle, ſo that no graſs ſeeds can be formed, the plants in this caſe propagate themſelves by the root. A cloſe matted turf is formed, which ſends forth great numbers of more ſlender and delicate ſtems, which are incapable of riſing up and forming a good crop of hay, though they afford a very ſweet and grateful kind of paſturage for cattle; while, on the contrary, a field on which hay crops have uſually been raiſed, when ſuddenly uſed for paſturing cattle, is unſuitable for the purpoſe; becauſe the plants are few, and theſe, in the earlieſt ſtages of their growth, are of a lean, hungry, and coarſe nature. To attempt, therefore, to intermix theſe two ways of uſing graſs by cutting a field, and by paſturing it for a length of time on alternate years, is to adopt a ſure plan for having neither good hay nor good paſture. Culture of Grais.

In the farther diſcuſſion of the ſubject, we ſhall conſider, firſt, the modes which may with propriety be adopted for the improvement of graſs lands, independent of the uſe of the plough, or of flooding. Secondly, The mode of improving graſs where the aid of the plough is to be called in. Thirdly, We ſhall mention the particular graſs plants that ought in either caſe to be cultivated; and, laſtly, We ſhall give an account of the mode of improving graſs lands by flooding them artificially with water.

Culture of Grafs.

1. *Improvement of Graſs without the aid of the plough, or of watering.*

Good graſs not to be broken up.

In many parts of Great Britain, more eſpecially around the ſeats of country gentlemen, there are rich old paſtures which have laſted for ages, without what is called fog, or the moſs plants, having grown up or encroached upon the graſſes. In ſuch inſtances no improvement is neceſſary. Such lands are a treaſure, of which the plough is the key. They will at any time produce immenſe crops of grain; but after having done ſo, it is very difficult ſpeedily to reſtore the ſoil to its former ſtate, or to renew the value of the paſture, which is very great. In ſpeaking, therefore, of the improvement of paſtures, we muſt be underſtood as treating of thoſe of an inferior quality, or of what may be called *upland paſtures*.

Draining.

For the improvement of upland paſtures, then, the firſt ſtep to be adopted on all thoſe ſpots, where it may be neceſſary, conſiſts of draining, of the various forms of practiſing which we have already given a full account. No general rule can be given for the kind of drains, which ought to be adopted. This principle, however, muſt undoubtedly be kept in view by the huſbandman, as a rule of conduct common to all perſons engaged in commercial employments, that he ought not to expend more money upon the ſoil in draining than it is capable of repaying; at the ſame time, he ought not, for the ſake of avoiding preſent expence, to expoſe himſelf to a heavy annual expenditure in repairing his drains. Whether he is to uſe open or cloſe drains, or what kind of open drains (if ſuch are preferred) he is to adopt, muſt be determined by a due conſideration of the quality of the

the ſoil, or the endurance of his own leaſe or intereſt in it. Culture of Graſs.

In cold upland ſituations, encloſing is often no leſs neceſſary than draining for the improvement of the paſture, and the one practice very conveniently accompanies the other where open drains are uſed; as the ſame ditches which clear the ſoil of water ſerve alſo for dividing the fields. In the ſituations now mentioned, encloſing is beſt performed by means of belts of planting, with the addition of clumps of hardy trees on the pooreſt eminences. In this way, the extent of paſture, though diminiſhed by the ſpace occupied by the timber, will uſually remain ſufficient in conſequence of its amelioration, to afford liberal intereſt for the money laid out in encloſing, while at the ſame time the foreſt trees that are gradually riſing, will afford a great addition to the worth of the property. The expence of encloſing and planting, however, as it is intended for the permanent benefit and amelioration of the ſoil, can only be undertaken by a proprietor; or by a tenant, in conſequence of an allowance granted by the proprietor. Encloſing.

It is of conſiderable ſervice to roll the turf of paſture land in the months of February and March with a heavy wooden roller, always obſerving to do it in moiſt weather, that the roller may make an impreſſion. This practice has a conſiderable tendency to fix the roots of the graſs plants in the ſoil, which in ſome ſituations are otherwiſe apt to be caſt out. When this laſt event happens, fog ſpeedily ſprings up: The graſſes decay, and the paſture becomes of little value, though ſuch an event might eaſily have been prevented by the eaſy and unexpenſive practice of rolling. The graſs likewiſe is rendered ſweeter by this huſbandry, in conſequence of Rolling.

the

Culture of Graſs.

the tendency which the preſſure of the roller has by fixing, and, as it were, planting all the roots in the ſoil, to encourage a thick turf, or the growth of vaſt numbers of ſmall and delicate plants.

To ſtock with ſheep.

With a ſimilar view, it is of great value towards the improvement of all poor paſtures to ſtock them with ſheep in preference to black cattle, and even rather to overſtock them. Mr Young obſerves *, that it is the opinion of many eminent farmers, that nothing recruits poor ſoils ſo much as heartily feeding them with ſheep for ſome years, provided the ſheep are not folded from the land; and he himſelf has practiſed upon this principle with ſucceſs. The effect of keeping a very full ſtock of ſheep upon the land is, that they prevent any ſeed ſtems from riſing to exhauſt the ſoil, and thereby give to the graſs plants, which they keep conſtantly pared down and bare by their cloſe bite, a habit of mattening or ſpreading their roots, ſo as to form a firm turf and a cloſe growth of delicate graſſes. This, like every other valuable practice, may no doubt be overdone, particularly during a very hot and dry ſummer; becauſe, in ſuch a ſeaſon, if the land is much overſtocked with ſheep, they are under the neceſſity of biting ſo cloſe, that they are apt to deſtroy the roots of the graſs. In other reſpects, however, there is no doubt, that both by the mode of eating and by their dung, graſs lands are greatly ameliorated by being fully ſtocked with theſe animals. As there are very few plants, which they do not eat when young (furze, broom, and heath, not excepted), they have a great tendency

* *Annals of Agriculture*, vol. xxvii.

dency to clear paſture land of almoſt all noxious weeds, and to encourage the excluſive production of graſs. Culture of Graſs.

Theſe ideas are well ſupported by the following paſſage in an eſſay * by the Rev. Arthur Young, in which, after giving liſts of a few of the ordinary graſſes to be afterwards noticed, he proceeds thus: "But here I muſt obſerve generally, that if the land thus laid to graſs be intended for ſheep, it is not an object of very great conſequence to ſow only the finer graſſes, as cloſe feeding will make any graſs named in theſe liſts fine, ſweet, and productive; but this effect depends altogether on its being conſtantly fed cloſe, that is, all ſeed-ſtems being prevented from riſing. Every good farmer is ſenſible of the neceſſity of this with *rye-graſs*, but moſt unaccountably does not extend a ſimilar concern to other graſſes. Above 200 acres under my management have been laid down chiefly for ſheep, and I have ſtocked the fields ſo early in ſpring, and ſo thickly, as juſt to keep down the ſeed-ſtems: the *cock's-foot*, *oat-graſs*, and *Yorkſhire white*, with this management, have proved ſweet feeding graſſes, not at all rejected, even in fields where the flock had a choice. Several writers ſeem to have been very ſenſible of the conſequence of cloſe feeding.

"Mr Davis ſays, "The ſweetneſs of the feed on the downs of Wilts depends much more on its being kept cloſe, and eaten as faſt as it ſhoots, than on any particular good quality of the graſs itſelf; for there are many downs that, when cloſe fed, appear to be a very ſweet paſture, but which, if ſuffered to run a year or two

* *Communications to the Board of Agriculture*, vol. iii.

Culture of Grafs.

two without a full ſtock on them, will become ſo coarſe, that ſheep will almoſt as ſoon ſtarve as eat the grafs." (Wilts Report, p. 18.)

"Upon Ben-Lomond, &c. the paſturing of ſheep has evidently in the courſe of 20 years paſt improved the quality of the herbage, ſo as to raiſe grafs of a good ſpecies, and in very conſiderable abundance, where nothing formerly prevailed but bad kinds of grafs, and theſe in no great plenty; and the practice bids fair to baniſh heath from all the places that are paſtured by ſheep.

"Liſle, who was the beſt writer on huſbandry we had for many ages, remarks, (vol. ii. p. 79.), 'That there are poor ſoils which require a much longer time to grow a ſecond inch than the firſt; and that conſequently on ſuch it is much more profitable to keep ſheep than cattle.' The writer of this eſſay, on firſt reading this paſſage, made this experiment on land of 12s. and 15s. an acre, clipping the plant with ſciſſars, and carefully meaſuring and weighing the produce, and comparing it with neighbouring plants left to perfect the ſeed-ſtem: the ſuperiority was proportioned to the times of cutting." (Stirlingſhire Report, p. 49.)

Sheep-feeding not only ameliorates by enriching the ſoil and fining the herbage, but alſo by deſtroying weeds. *Ragwort*, with which the bullock-grounds of Limerick are overrun for want of ſheep, is much affected by them; and Mr Marſhal gives an inſtance (York Economy, vol. ii. 128.) of a meadow, foul in the extreme, with knobweed, cured by paſturing it repeatedly in the ſpring with ſheep.

"But here a counter remark muſt be made, which is, that after a field has been paſtured long with ſheep, and cloſe

cloſe fed, it becomes unable to yield a growth of hay; the plants by being conſtantly cropped down acquire a dwarfiſh habit; however quick the growth in that early ſtage. There is a ſmall field on this eſtate which has been under graſs time immemorial, and kept fed for the laſt 40 years at leaſt, except one year in which it was mown, expecting a vaſt crop: the ſeaſon was very favourable, but I was utterly diſappointed, for the produce was ſmall. I have known the ſame thing happen on encloſing an old common. In Scotland a ſimilar remark has been made. "Two incloſures of the ſame ſoil were laid down together with graſs-ſeeds of the ſame kind; after two years hay the one was ſurrendered to paſture; from the other a crop of hay was taken every other year. After ſeven years abſence the proprietor returned home, and wanting more hay, mowed both; and that which had been paſtured gave the worſt crop. Something like the ſame thing has been obſerved in Switzerland." Culture of Graſs.

There are few paſtures which may not be improved by the addition of quicklime in powder, ſpread out upon the ſurface. The moſs plants are the greateſt enemies of the graſſes, and as quicklime utterly conſumes and deſtroys them, it performs two ſervices to the paſture, or rather to the graſſes which form the paſture. In the firſt place, it deſtroys the moſt dangerous rival of the graſſes; and ſecondly, it converts that rival, or the fog, into a valuable manure for the amelioration of the ſoil. An example of ſucceſsful improvement in this way is ſtated in the Annals of Agriculture *, as performed by a county member of parliament. Lime.

"About

* Vol. xxiv.

Culture of Grais.

" About eighteen years ago, I took about eighty Scots acres of land that had been arable, but left to graſs for four or five years, of which, above twenty were of a very bad ſoil, part of the reſt only middling, and about two-thirds of a good natural light ſoil; but the whole had been left out in a very bad order by the tenant. I incloſed the whole in one field by a very good dry ſtone wall, four feet and a half high, beſides two rows of turf on the top. I gave it at the rate of about 300 Wincheſter buſhels of ſlaked lime to the Scotch acre on the ſward in ſummer, and did nothing elſe in the way of improvement or of cleaning it.

" The expence of incloſing and liming of the whole amounted to about 320l.

" Ever ſince I have let it for ſummer paſture only by auction; at firſt it let for leſs than 16l.; the rent roſe gradually. About ſix or ſeven years ago it let for about 40l.; for the two laſt years between 50l. and 53l. per annum; and this year (1795) it let for 75l.

" I ſuſpect this extraordinary rent has been owing to a competition; but I certainly reckon that it will produce a fair good rent of about 60l. or perhaps more. The Scots acre is to the Engliſh as 1270 to 1000.

" The tenants who have hired it have applied it moſtly to feeding cattle, and perhaps a few horſes; never to feeding ſheep. By the information I could get it was ſufficient to feed well during the ſummer ſixty head of black cattle.

" The importance of liming does not only appear from this trial upon worn-out and exhauſted land, for I have remarked the ſame great effect on ſoils in much better heart; for inſtance, in the diviſion of farms that were many years ago the *infield* parts, and which having

ing

ing for many years received all the dung of the farm, were in good condition when laid to graſs, though by no means clean: the limed parts of theſe have ſuch a ſuperiority that the good effect could not be doubted. Culture of Graſs.

"I have found, by a number of experiments, that the good effects of mixing lime with tolerable earth, taken off the ſurface, or from ponds, ditches, or quagmires, have been much ſuperior to uſing it alone. I mix in general about double the quantity of earth to that of lime; but the proportion which is ſufficient to ſaturate the earth varies, but is eaſily known by the workmen themſelves from experience. If the land is moſs it ſhould be harrowed, after froſt, before the earth and lime are laid on it; this deſtroys the moſs completely. It is well known that all land ſhould be perfectly drained before calcareous earth is applied to it."

Paring and burning when applied to paſtures, is likewiſe a valuable improvement. It may either be applied partially or generally. If the ground is overrun with buſhes or ruſhes, it will be of great advantage to the land to grub them up towards the latter part of ſummer, and after they are dried to burn them, and ſpread the aſhes over the ground juſt before the autumnal rains, at which time the ſurface of the land ſhould be levelled and ſown with graſs-ſeeds, which will come up in a ſhort time, and make good graſs the following ſpring. So alſo when the land is full of mole or ant-hills, theſe ſhould be pared off, and either burnt for the aſhes, or ſpread immediately on the ground where they are pared off, obſerving to ſow the bare patches with graſs-ſeed juſt as the autumnal rains begin. Paring or burning.

That paring and burning may be advantageouſly applied over the whole ſurface of the ſoil cannot

Culture of Graſs.

be doubted, providing always that proper graſs-ſeeds are ſown. In the Annals of Agriculture (vol. xxxiv.) the following inſtance of this practice is recorded: "Thomas Bradford Eſq. now of Aſhdown park, near Grinſtead in Suſſex, when he lived near Doncaſter ſome years ago, pared and burned a poor worn-out ley, ſpread the aſhes, and harrowed in white clover, rye-graſs, rib-graſs, and trefoil, without any ploughing; and it has ever ſince been a very fine meadow. This is a remarkable experiment that deſerves much attention, for it is applicable to caſes in which ſuch management would prove uncommonly convenient. It is, where ſuitable, the cheapeſt of all improvements."

2. *Of the Culture of Graſs by the aid of the Plough.*

Conſiderable information has been obtained, or rather diffuſed, upon this ſubject, in conſequence of the premiums offered by the Board of Agriculture for Eſſays upon the means of converting graſs lands into tillage without exhauſting the ſoil, and of reſtoring them to permanent graſs again in an improved, or at leaſt in an uninjured ſtate.

Reaſons for breaking up graſs.

Graſs or paſture lands are uſually brought under the plough for one of two reaſons. On thoſe rich ſoils where the paſture is permanently good, and where the cloſe turf continues to produce valuable graſſes without intermixture of fog or other coarſe plants, a landlord is ſometimes tempted to break up the ſoil for the ſake of the rich crops of grain which the vegetable mould which has for years been accumulating at the ſurface enables it for a certain time to yield. In ſuch a caſe, however, unleſs great care is uſed in preſerving or in reſtoring to the ſoil what it has loſt by this treatment, the proprietor

proprietor is extremely apt to find that he has been ſqueezing the orange, of which he retains only the empty rind. Culture of Graſs.

Leſs valuable paſtures are frequently broken up, and indeed ought to be ſo, for their improvement. When, in conſequence of the bleakneſs of the climate, or the exhauſted ſtate in which the land was formerly laid down to paſture, the moſs plants have prevailed over the graſſes, or when the lands have come to be covered with fern, ruſhes, and ant-hills, it is uſually advantageous to ſubject them for ſome time to the plough, that an opportunity may be afforded of permanently ameliorating the paſture.

To prepare lands for graſs, the ſame rules muſt be attended to and obſerved that are neceſſary for preparing them to yield rich crops of grain, that is to ſay, the lands muſt be cleaned or freed of weeds, and they muſt be brought into good heart, or well manured. To cultivate any particular plant, the firſt and moſt neceſſary ſtep to be taken, undoubtedly, is to remove every rival from the ſoil, that it may be able alone to occupy its whole powers. This is no leſs neceſſary, if we wiſh to rear particular graſſes, than if we wiſh to obtain crops of certain kinds of grain. That the land which is to be converted into paſture ought to be in good condition, is perhaps ſtill more obvious, as it is in vain to expect that valuable plants will grow without nouriſhment. It is true, that in a good climate, if exhauſted land is left to itſelf, nature will gradually produce ſome ſort of improvement on its ſurface. Plants of ſome kind or other will ſpring up, and by the rotting of their leaves and roots, will, in time, produce a portion of vegetable mould, which may ſerve to nouriſh ſome of the graſſes, or if torn up by the Preparation of arable lands for graſs.

Culture of Graſs.

plough, to give for a year or two good crops of grain. It is this circumſtance which has probably introduced a conſiderable negligence of conduct on the part of many farmers, with regard to the cultivation of graſs. Such conduct, however, ought to be carefully avoided by every true agriculturiſt, that is, by every man who is endeavouring to derive from the ſoil the higheſt profit which it is capable of yielding in a ſhort time.

Rotation of crops.

The great art of cleaning a ſoil, and at the ſame time of bringing it into good heart by providing abundance of manure, conſiſts of ſubjecting it to a judicious previous rotation or courſe of crops. Upon this ſubject, which is extremely important, we have already made ſome remarks, when treating of the proper modes of bringing land into culture from a ſtate of nature. The general rule is, that excepting upon a very ſtiff clay, which from the fear of poaching may not admit of ſuch a practice, the beſt of all immediate preparations for graſs, conſiſts of a crop of turnips conſumed by cattle upon the field; as, in this way, if the turnips are properly cultivated, the land will be at once cleaned and manured. This arrangement is uncommonly advantageous where lands have been broken up to ameliorate a poor paſture, becauſe turnips ſcarcely fail to ſucceed wherever they enjoy a new ſoil, or the manure afforded by freſh turf; in other caſes, artificial manure is neceſſary to bring forward a heavy crop, without which the preparation for graſs will be incomplete; as a ſcanty crop, affording little food for cattle, will not enable them in their turn to improve the ſoil by dung. In this caſe, the beſt mode is to repeat the turnip crop on the ſucceeding year. Where there is abundance of manure, however, but not otherwiſe, a crop of cabba-

ges,

ges, treated in the ſame manner, is perhaps ſtill more valuable than turnips. It unites every advantage of the drill huſbandry in cleaning the land, with the benefit which the ſoil derives from a ſhading or ſmothering crop, concluding with the production of abundance of manure. Culture of Graſs.

On clay land the management ſhould be different. The ſoil ſhould be amply manured in autumn or ſpring, in the drieſt weather, when carting can be performed without injury. One ploughing ought to be given in autumn, and three or four more in ſummer previouſly to Auguſt, when the ſeeds are to be ſown.

With regard to the more immediate preparation of land for graſs ſeeds, it is a celebrated queſtion, about which various opinions have been entertained and much written, Whether graſs ſeeds ought to be ſown along with a crop of corn in ſpring, or after a ſummer fallow in Auguſt without corn? The Rev. Mr Arthur Young ſtates the ſubject in the following terms *: "Much has been written on the compariſon of theſe ſeaſons, and whether with corn in ſpring, or without it in Auguſt. But Mr Lyſter of Bawtrey compared them, and found the latter much the better. Mr Dickſon of Belford made a comparative experiment, but all in the ſpring: Four acres with graſſes alone, on peaſe and buck-wheat ploughed in the preceding autumn; five acres with barley, and five the ſeeds alone without either corn or manure. The two diviſions ſown alone were overrun with chickweed, and would have been choked, but a dairy of cows ate it. From that time, Graſſes ſown with or without corn.

* *Communications to the Board of Agriculture*, vol. iii.

Culture of Graſs.

for ſeven years, no difference perceptible between the three diviſions. The earl of Holderneſs laid down large tracts of land, both at Hornby Caſtle and Sion, and found by experiments, that the ſeeds anſwered beſt when ſown alone.

"Other authorities (continues this writer) might be quoted, but the fact is, that the ſeeds will ſucceed almoſt equally well in either method; though if I did give the preference, it ſhould be to Auguſt ſowings without corn; but the ſucceſs I have witneſſed in both ſeaſons does not allow any poſitive opinion. Moor and mountains are an exception. In ſuch ſituations ſnows come too early to venture ſuch ſowings; on ſuch I do not think that graſs-ſeeds ſhould ever be ſown in autumn, nor ventured later than the firſt week in Auguſt: but the better ſeaſon is the ſpring; and with oats, not for a crop of corn, but following the too general advice of an Italian author, to mow it, before the ſeeds ripen, either for ſoiling or for hay."

On the other hand, the ſubject is thus treated in an Eſſay addreſſed to the Board of Agriculture, by the Rev. H. J. Cloſe *. "A friend of mine wiſhed to procure a good meadow or paſture around his houſe; he fallowed the land for barley; but the ſpring proving wet, and the ſoil being a ſtrong loam, he could only put half of it in order for that crop, which was ſown, and laid with clover and rye-graſs. The other part was fallowed and ſown in Auguſt with the ſweepings of hay chambers, as I have recommended. The barley was a good crop, and the clover and rye-graſs were probably equal to

* *Communications*, vol. iii.

to the firſt year's cut of hay. The ſecond year the artificial graſſes began to fail; worſe the third, fourth, and fifth: the ſixth year, after having received two dreſſings, the ſpontaneous product of the ſoil began to give a fleece over the ſurface of the land. About two years after theſe lands were ſown, I ſaw this field, when the part ſown in Auguſt was worth at leaſt 15s. per acre more than the part which had been ſown with artificial graſſes in the barley. Thus, from actual experiments, numbers of which I could adduce, it appears that ſowing the ſweepings of hay chambers in Auguſt, is preferable to ſowing artificial graſſes in the ſpring with any crop of corn. Suppoſe the corn worth 5l. per acre, the difference of the produce of hay or ſeed in the ſecond, third, fourth, and fifth years, would more than counterbalance this; and the proprietor would find a permanent improvement in his land of from 15s. to 20s. per acre. "Sowing rubbiſh in Auguſt is not of ſo great importance as in the ſpring. In the former ſeaſon all the annual ſeeds vegetate, and if the beginning of the winter be mild, they will bloſſom; but they cannot perfect their ſeed, and the firſt froſt deſtroys them. If ſown in the ſpring, they vegetate, bloſſom, perfect, and ſhed their ſeeds, and thus ſtock the land with noxious weeds." Culture of Graſs.

Upon this queſtion of ſowing graſs ſeeds with or without a crop of corn, the fact appears to ſtand thus: That graſs ſeeds will undoubtedly thrive under a corn crop, eſpecially barley, which is ſooneſt removed from the ground, and comes up with a ſlender ſtalk ſo as not to overſhadow the young graſs plants; but it ought to be remembered, that every corn crop, which is ſuffered to bring its ſeeds to maturity, robs the ſoil of a great por- Opinion on the ſubject.

Culture of Graſs.

tion of its fertilizing powers. Whatever therefore is gained by the crop of corn, is in ſome meaſure loſt by the ſucceeding crop of graſs. The laſt quoted writer remarks, that "ſhould it be thought proper to ſow the ſeeds with any corn, barley muſt have the preference. If ſown with oats, and the land prepared as it ſhould be, viz. in high tilth and order, the oats will be ſo luxuriant as to ſmother and deſtroy the young plants. Lands intended for graſs or meadow cannot be in too high a ſtate of cultivation. The permanent improvement in the intrinſic value of the land will abundantly repay almoſt [illegible] pence. To improve the ſoil with this view, and then to exhauſt it by a crop of corn at the time of ſowing the ſeeds, appears to me a ſure method of counteracting the very object in view."

Whether grain, therefore, is or is not to be ſown with graſs-ſeeds, will, at leaſt upon open and light ſoils, be a queſtion, the anſwer to which muſt chiefly depend upon the ſtate in which the land actually is. In the neighbourhood of a city, and where dung can be procured in abundance, it will be prudent, in this as in every other caſe, to ſacrifice manure, in place of ſacrificing time and labour, by allowing the ſoil to remain fallow.

Autumnal management.

Whether graſs-ſeeds be ſown in the ſpring along with corn, or in Auguſt after a fallow, the autumnal management will be equally important. All trampling by cattle and horſes is pernicious: for the ſoil, after a crop of corn, or after the tillage of a fallow, is very tender, and eaſily affected by every impreſſion; it is alſo bad to feed the plants, as has been found by experience. The ſafe way is to keep every thing out through both autumn and winter. The profit of feeding is abſolutely

lutely nothing; for the paſturage in the ſpring for ſheep is of far more value, by reaſon of not eating it in autumn: at the former ſeaſon it affords a moſt valuable and very early bite for ewes and lambs. Culture of Graſs.

When permanent paſture is intended, the ſubject of its treatment, during the firſt crop, has already in ſome meaſure been diſcuſſed. A crop of hay ought by no means to be taken. If the graſs, however, is mown, it ought at leaſt to be done early, that the ſoil may not be exhauſted by the graſs running to ſeed. The proper mode of treatment during the firſt year, conſiſts of feeding with ſheep, unleſs very great quantities indeed of the beſt manure can be afforded to be ſpread upon the ſurface after the crop of hay. At the ſame time, the number of ſheep ſhould not be ſo great nor kept ſo long, eſpecially in a dry ſeaſon, as to endanger the plants, by being nibbled too cloſe. "If bents riſe," ſays the Rev. Mr Arthur Young, in the Eſſay already quoted, "as they will do, let them be ſwept with a ſcythe before any of them ſeed, unleſs the plants be evidently too thin on the ground: In that caſe, the ſeed falling may do more good by raiſing freſh plants, than harm to thoſe which yield the ſeed. Though I have little doubt that feeding is the right management, yet it is not to be concluded, that with mowing, the graſs will not ſucceed; Lord Rockingham's new leys, viewed in the autumn of the firſt year, were, by deſcription, among the fineſt that have been ſeen; they were manured, however, the autumn after ſowing, which is admirable management, provided the ſoil be found and the ſeaſon very dry. First years treatment.

"But it is not only the firſt year that ſheep-feeding is the beſt management for a new ley; there is no neceſſity

Culture of Grafs.

ceſſity of continuing it longer; but I have had ſome fields under my care, which ſucceeded well in feeding four, five, and even ſix years; and, in general, it may be laid down as a rule, that the more the land is ſheep-fed, the more it will be improved; and eſpecially if it be ever to be ploughed again for corn. But when ſheep-feeding encloſures are mentioned, it is underſtood, that the ſheep are not to be removed from ſuch fields to be folded elſewhere; a ruinous, impoveriſhing, unneceſſary ſyſtem, of which the farmers are too fond, as they are of every way of robbing graſs to favour corn."

Importance of feeding with ſheep.

Management if the crop fail.

Should a total failure of the graſs crop take place from any unforeſeen cauſe, the beſt conduct, adds the ſame author, will be in "fields that were ſown in the ſpring, to clean the corn as early as poſſible, and ploughing once to harrow in freſh ſeeds immediately: theſe will ſucceed very well if they be got in during the month of Auguſt; the ſooner the better; and in this caſe, the land ſhould be very well rolled in October in a dry ſeaſon. If the failure happen on land ſown in Auguſt, it ſhould have three earths in dry weather in the ſpring, and graſs-ſeeds re-ſown with buck-wheat in May. It is not a crop for clays and wet loams; but I have known it ſucceed well in a dry ſummer: ſhould the ſeaſon be wet it will give little ſeed, and ſhould be mown when in bloſſom for ſoiling cows. It is an ameliorating plant never exhauſting any ſoil; and therefore preſerves in the land the fertility gained by the operations previous to the former ſowing. And I may here generally obſerve, that graſs-ſeeds of all ſorts and on all ſoils, never ſucceed better than with buck-wheat, of which not more than one buſhel an acre ſhould be ſown. There is a diſtrict in Norfolk where buck-wheat

is highly valued for this object. It is a profitable article of cultivation on the very pooreſt barren ſands." Culture of Graſs.

3. *Of the particular Graſſes that ought to be Cultivated.*

Culmiferous graſſes may be divided into two general claſſes for the purpoſes of the farmer, that it might be of uſe for him to attend to: viz. 1ſt, Thoſe which, like the common annual kinds of corn, run chiefly to ſeed-ſtalks; the leaves gradually decaying as they advance towards perfection, and becoming totally withered or falling off entirely when the ſeeds are ripe. Rye-graſs belongs to this claſs in the ſtricteſt ſenſe. To it likewiſe may be aſſigned the vernal graſs, dogs-tail graſs, and fine bent graſs. 2dly, Thoſe whoſe leaves continue to advance even after the ſeed-ſtalks are formed, and retain their verdure and ſucculence during the whole ſeaſon; as is the caſe with the feſcue and poa tribes of graſſes, whoſe leaves are as green and ſucculent when the ſeeds are ripe and the flower-ſtalks fading, as at any other time. Culmiferous graſſes.

"It is wonderful, Mr Stillingfleet* remarks, to ſee how long mankind have neglected to make a proper advantage of plants of ſuch importance, and which, in almoſt every country, are the chief food of cattle. The farmer, for want of diſtinguiſhing and ſelecting graſſes for ſeed, fills his paſtures either with weeds, or bad or improper graſſes; when, by making a right choice, after ſome trials, he might be ſure of the beſt graſs, and in the greateſt abundance that his land admits of. At preſent, if a farmer wants to lay down his Indiſcriminate ſowing of graſſes.

* *Tracts relating to Nat. Hiſt.* &c.

Culture of Graſs.

his land to graſs, what does he do? he either takes his ſeeds indiſcriminately from his own foul hay rack, or ſends to his next neighbour for a ſupply. By this means, beſides a certain mixture of all ſorts of rubbiſh, which muſt neceſſarily happen, if he chances to have a large proportion of good ſeeds, it is not unlikely but that what he intends for dry land may come from moiſt, where it grew naturally, and the contrary. This is ſuch a ſlovenly method of proceeding, as one would think could not poſſibly prevail univerſally: yet this is the caſe as to all graſſes, except the darnel-graſs, and what is known in ſome few counties by the name of the *Suffolk-graſs*; and this latter inſtance is owing, I believe, more to the ſoil than any care of the huſbandman. Now, would the farmer be at the pains of ſeparating once in his life half a pint or a pint of the different kinds of graſs ſeeds, and take care to ſow them ſeparately, in a very little time he would have wherewithal to ſtock his farm properly, according to the nature of each ſoil, and might at the ſame time ſpread theſe ſeeds ſeparately over the nation, by ſupplying the ſeed ſhops. The number of graſſes fit for the farmer is, I believe, ſmall; perhaps half a dozen or half a ſcore are all he need to cultivate; and how ſmall the trouble would be of ſuch a taſk, and how great the benefit, muſt be obvious to every one at firſt ſight. Would not any one be looked on as wild who ſhould ſow wheat, barley, oats, rye, peaſe, beans, vetches, buck-wheat, turnips, and weeds of all ſorts together? yet how is it much leſs abſurd to do what is equivalent in relation to graſſes? Does it not import the farmer to have good hay and graſs in plenty? and will cattle thrive equally on all ſorts of food? We know

know the contrary. Horſes will ſcarcely eat hay that will do well enough for oxen and cows. Sheep are particularly fond of one ſort of graſs, and fatten upon it faſter than any other, in Sweden, if we may give credit to Linnæus. And may they not do the ſame in Britain? How ſhall we know till we have tried?" Culture of Graſs.

Notwithſtanding what is above ſtated, concerning the impropriety of ſowing graſs ſeeds indiſcriminately, this practice has its advocates. The Rev. Mr Cloſe, in the eſſay above-quoted, remarks that "many object to ſowing ſuch rubbiſh as the ſweepings of hay chambers produce; and I wiſh moſt ſincerely any method could be deviſed for procuring clean ſeeds of our beſt and natural meadow graſſes. It is a great deſideratum, and premiums to encourage agriculturiſts to ſow ſeeds of the feſcues and poas, &c. and for the largeſt quantity of land ſown with theſe ſeeds, and kept diſtinct, might be of infinite ſervice. Until this can be effected, the above plan appears to me the moſt eligible. It certainly has been crowned with the greateſt ſucceſs." This opinion, however proceeds only upon the ſuppoſition that proper graſs-ſeeds cannot be obtained, a difficulty or rather an evil which is daily declining.

The graſſes commonly ſown for paſture, for hay, or to cut green for cattle, are red clover, white clover, yellow clover, rye-graſs, rib-graſs, ſainfoin, lucerne, &c. Kinds of graſs commonly ſown.

Red clover is of all the moſt proper to be cut green for ſummer food, and its great value as a preparation for wheat has already been noticed. It is a biennial plant when ſuffered to perfect its ſeed; but when cut green, it will laſt three years, and in a dry ſoil longer. At the ſame time the ſafeſt courſe is to let it ſtand Red clover.

but

Culture of Graſs.

but a ſingle year: if the ſecond year's crop happen to be ſcanty, it proves, like a bad crop of peaſe, a great encourager of weeds by the ſhelter it affords them.

Here, as in all other crops, the goodneſs of ſeed is of importance. Chooſe plump ſeed of a purple colour, becauſe it takes on that colour when ripe. It is red when hurt in the drying, and of a faint colour when unripe.

Red clover is luxuriant upon a rich ſoil, whether clay, loam, or gravel: it will grow even upon a moor, when properly cultivated. A wet ſoil is its only bane; for there it does not thrive.

Culture of red clover.

To have red clover in perfection, weeds muſt be extirpated, and ſtones taken off. The mould ought to be made as fine as harrowing can make it; and the ſurface be ſmoothed with a light roller, if not ſufficiently ſmooth without it. This gives opportunity for diſtributing the ſeed evenly: which muſt be covered by a ſmall harrow with teeth no larger than thoſe of a garden rake, three inches long, and ſix inches aſunder. In harrowing, the man ſhould walk behind with a rope in his hand fixed to the back part of the harrow, ready to diſentangle it from ſtones, clods, turnip or cabbage roots, which would trail the ſeed, and diſplace it.

Nature has not determined any preciſe depth for the ſeed of red clover more than of other ſeed. It will grow vigorouſly when two inches deep, and it will grow when barely covered. Half an inch may be reckoned the moſt advantageous poſition in clay ſoil, a whole inch in what is light or looſe. It is a vulgar error, that ſmall ſeed ought to be ſparingly covered. Miſled

by

by that error, farmers commonly cover their clover ſeed with a buſhy branch of thorn; which not only covers it unequally, but leaves part on the ſurface to wither in the air. Culture of Graſs.

The proper ſeaſon for ſowing red clover, is from the middle of April to the middle of May. It will ſpring from the firſt of March to the end of Auguſt; but ſuch liberty ought not to be taken except from neceſſity.

There cannot be a greater blunder in huſbandry than to be ſparing of ſeed. Speculative writers talk of ſowing an acre with four pounds. That quantity of ſeed, ſay they, will fill an acre with plants as thick as they ought to ſtand. This rule may be admitted where grain is the object; but it will not anſwer with reſpect to graſs. Graſs ſeed cannot be ſown too thick: the plants ſhelter one another; they retain all the dew; and they muſt puſh upward, having no room laterally. Obſerve the place where a ſack of peaſe, or of other grain, has been ſet down for ſowing: the ſeed dropt there accidentally grows more quickly than in the reſt of the field ſown thin out of hand. A young plant of clover, or of ſainfoin, according to Tull, may be raiſed to a great ſize where it has room; but the field will not produce half the quantity. When red clover is ſown for cutting green, there ought not to be leſs than 24 pounds to an acre. A field of clover is ſeldom too thick: the ſmaller a ſtem be, the more acceptable it is to cattle. It is often too thin; and when ſo, the ſtems tend to wood. Thick ſowing.

Grain may be ſown more ſafely with red clover than with almoſt any other graſs; and the moſt proper grain has been found to be flax. The ſoil muſt be highly Of ſowing clover with grain.

Culture of Grafs. highly cultivated for flax as well as for red clover. The proper ſeaſon of ſowing is the ſame for both; the leaves of flax being very ſmall, admit of free circulation of air; and flax being an early crop, is removed ſo early as to give the clover time for growing. In a rich ſoil it has grown ſo faſt, as to afford a good cutting that very year. Next to flax, barley is the beſt companion to clover. The ſoil muſt be looſe and free for barley; and ſo it ought to be for clover: the ſeaſon of ſowing is the ſame; and the clover is well eſtabliſhed in the ground before it is over-topped by the barley. At the ſame time, barley commonly is ſooner cut than either oats or wheat. In a word, barley is rather a nurſe than a ſtepmother to clover during its infancy. When clover is ſown in ſpring upon wheat, the ſoil which has lain five or ſix months without being ſtirred, is an improper bed for it; and the wheat, being in the vigour of growth, overtops it from the beginning. It cannot be ſown along with oats, becauſe of the hazard of froſt; and when ſown as uſual among the oats three inches high, it is overtopped, and never enjoys free air till the oats be cut. Add, that where oats are ſown upon the winter furrow, the ſoil is rendered as hard as when under wheat.—Red clover is ſometimes ſown by itſelf without other grain: but this method, beſide loſing a crop, is not ſalutary; becauſe clover in its infant ſtate requires ſhelter.

As to the quantity of grain proper to be ſown with clover: In a rich ſoil well pulverized, a peck of barley on an Engliſh acre is all that ought to be ventured; but there is not much ſoil in Scotland ſo rich. Two Linlithgow firlots make the proper quantity for an acre that produces commonly ſix bolls of barley; half

a firlot for what produces nine bolls. To thoſe who are governed by cuſtom, ſo ſmall a quantity will be thought ridiculous. Let them only conſider, that a rich ſoil, in perfect good order, will from a ſingle ſeed of barley produce 20 or 30 vigorous ſtems. People may flatter themſelves with the remedy of cutting barley green for food, if it happen to oppreſs the clover. This is an excellent remedy in a field of an acre or two; but the cutting an extenſive field for food muſt be ſlow; and while one part is cutting, the clover is ſmothered in other parts. Culture of Graſs.

Mr Cloſe, whoſe eſſay has been already quoted, ſtrongly recommends the ſowing of barley in drills when clover is intended to be raiſed along with it. He thus deſcribes his mode of proceeding and its advantages: "From many years practice I am convinced that the moſt certain method of obtaining a crop of clover, or other graſſes, without injury to the barley, is to ſow the lands previous to the laſt horſe-hoeing. The advantages of this method I have experienced by long practice, and they ſeem confirmed by theory. The barley being twice horſe or hand hoed previous to ſowing the ſeeds, will not only be clear from annual weeds, but a fine tilth will be obtained for the ſeeds; the blades of corn meeting over the intervals, will protect the young plants from the depredations of the fly, and from the ſcorching ſun; the moiſture of every dew will be retained under the ſhade of the corn; and the ſeeds, by being ſown a month or ſix weeks after the barley, will never exhauſt themſelves too much the firſt ſummer, nor riſe ſo high as to interfere with harveſting the barley. In a moiſt ſeaſon, when the ſeeds are ſown early with the barley, the land is frequently full of annual Clover ſown on drilled barley.

Culture of Graſs.

nual weeds; the young plants of clover are taken off by the fly, and if they flouriſh, expend themſelves ſo much, that when you expect a full and firſt crop of clover, you have ſomething like a ſecond year's cut; and many fields of barley have been rendered uſeleſs for all the purpoſes of malting, by having ſo large a portion of rich ſucculent clover in the crop as to prevent their being harveſted."

Clover ſeed how collected.

When red clover is intended for ſeed, the ground ought to be cleared of weeds, were it for no other purpoſe than that the ſeed cannot otherwiſe be preſerved pure: what weeds eſcape the plough ought to be taken out by the hand. In England, when a crop of ſeed is intended, the clover is always firſt cut for hay. This appears to be done, as in fruit trees, to check the growth of the wood, in order to encourage the fruit. This practice will not anſwer in Scotland, as the ſeed would often be too late for ripening. It would do better to eat the clover with ſheep till the middle of May, which would allow the ſeed to ripen. The ſeed is ripe when, upon rubbing it between the hands, it parts readily from the huſk. Then apply the ſcythe, ſpread the crop thin, and turn it carefully. When perfectly dry, take the firſt opportunity of a hot day for thraſhing it on boards covered with a coarſe ſheet. Another way, leſs ſubject to riſk, is to ſtack the dry hay, and to thraſh it in the end of April. After the firſt thraſhing, expoſe the huſks to the ſun, and thraſh them over and over till no ſeed remain. Nothing is more efficacious than a hot ſun to make the huſk part with its ſeed; in which view it may be expoſed to the ſun by parcels, an hour or two before the flail is applied.

The

The following mode of collecting red clover ſeed is deſcribed by Ezra L'Hommedieu, Eſq. of New York *, as practiſed in Suffolk county, North America, and deſerves notice. Culture of Graſs.

" When you perceive about one half of the field to have changed its colour by the drying of the clover heads, you then begin to collect them, which is done by a machine invented at Brookhaven in Suffolk county: It is drawn by a horſe, and guided by a man or boy, who will collect from the field by this means the heads of clover growing on five acres in one day: the price of collecting is 2s. 6d. per acre. This machine is of a ſimple conſtruction; it is nothing more than an open box of about four feet ſquare at the bottom, and about two feet high on three ſides. One part, which we may call the fore-part, is open; on this part are fixed fingers, ſimilar to the fingers of a cradle, about three feet long, and ſo near together as to break off the heads from the clover ſtocks which are taken between thoſe fingers: the heads are thrown back into the box as the horſe walks on. The box is fixed on an axle-tree, ſupported by two ſmall wheels of about two feet diameter. Two handles are fixed to the box behind, by which the man or boy, at the ſame time he guides the horſe, lowers or raiſes the fingers of the machine, ſo as to take off all the heads from the graſs: as often as the box gets full of heads they are thrown out, and the horſe goes on again. Clover ſeed how collected in America.

" Another inſtrument is uſed for collecting hay-ſeed, which is called a *cradle*; it is made of a piece of oak-board of about eighteen inches long and ten broad;

* *Annals of Agriculture*, vol. xx.

Culture of Graſs.

about nine inches of this board, which we may call the fore part, is ſawed into fingers of about nine inches long; a handle is fixed into the board, on the back part, almoſt at right angles, inclining towards the fingers; a cloth is put round the back part of the board, which is cut rounding and raiſed on the handle; this collects or keeps from ſcattering the heads which are ſtruck off from the graſs by this cradle; different ſizes are uſed; leſs than the above deſcribed for women and children, who collect large quantities in this way.

"All the heads of clover, in what manner ſoever collected, ought to be put into ſmall heaps or cocks in the field, and there expoſed, that the huſk may rot, (which generally takes about three weeks in Suffolk county), otherwiſe it will be very difficult to get out the ſeed. Some attention ought to be paid to theſe heaps, or cocks, leſt they ſhould rot too much next to the ground. It will ſometimes be neceſſary, in caſe of much rain, to turn the heap by rubbing the heads in your hand; it may eaſily be perceived when the huſk is ſufficiently rotten and dry: they are carted into the barn, and whenever it is found convenient, the ſeed is thraſhed out on the barn-floor, and cleaned with a wire-riddle."

White clover.

White or Dutch clover (*trifolium repens*) has hitherto been the chief dependence of thoſe who have laid down land permanently to graſs, and is upon the whole the beſt kind of graſs that can be relied on, for all rich or dry loams, ſands, &c. and alſo for rich clays that have been properly drained, and peats; but on poor wet loams and clays it ſpeedily wears out, and gives way to various noxious plants, particularly the coarſe water-graſs (*agroſtis ſtolonifera*). There exiſts not perhaps a better

ter teſt of the goodneſs of a ſoil than the circumſtance of its producing this plant ſpontaneouſly when left unploughed. Whatever graſs-ſeeds are ſown for paſture, therefore, white clover ought to form a part. When cloſe fed it has great ſweetneſs for all kinds of ſtock; though when this is neglected, this, like ſeveral other graſſes, would ſeem to become leſs valuable for ſheep: for it will be obſerved, that for the preſervation of the various ſpecies of plants, nature has provided that their ſeeds or flowering ſtems ſhould be unacceptable to this otherwiſe cloſe-biting animal. Culture of Graſs.

White clover is much improved by the ground being rolled at proper periods after the graſs is up; for as this plant puts out roots from every joint of the branches which are near the ground, ſo by preſſing down the ſtalks the roots mat ſo cloſely together as to form a ſward that covers the whole ſurface of the ground, and forms a thick green carpet of great power in reſiſting drought; hence, if we examine in a very dry ſummer the common paſtures, we ſhall find that the patches of this white honeyſuckle graſs exhibit the only inſtances of verdure remaining in the fields.

White clover intended for ſeed may be managed in Scotland in the manner already directed for red clover.

Rye-graſs (*lolium perenne*) is for many purpoſes a very valuable kind of graſs; it will flouriſh on any land except ſtiff clay, and will grow even on that. Upon rich light ſoils it is not only a good ſpring-graſs, but the beſt kind of it, if properly managed by due mixtures of other graſſes, ſuits well for permanent paſtures. Rye-graſs.

Rye-graſs has a greater reſemblance to grain than almoſt any of the other graſſes; if ſuffered to ripen its ſeed, and thereafter cut for hay, it is an exhauſting or

Culture of Graſs.

impoveriſhing crop. Like oats or barley, if cut green before the ſeed forms, it will afford various other cuttings during the ſame ſeaſon, in proportion to the favourableneſs of the weather; but, like them, if its ſeed is once formed, its growth is ſtopped for that year. When inſtead of being cut for hay it is cloſe fed, it puts out a great variety of roots and ſmall ſtems, and forms cloſe and delicate herbage.

In ſeveral Engliſh counties they complain that the quality of rye-graſs has of late very much degenerated. The original kind produced a white ſtalk and a white ſeed, and is a perennial graſs. The degenerate kind has a purple ſtalk, and a blackiſh ſeed, and has almoſt become an annual. Mr Peacy of North Leach, in Wilts, has gained much profit from ſelecting and ſelling the true ſort to the farmers of ſeveral counties. Its excellencies are, ſuperior luxuriance in autumn, a longer duration in the ſoil, and that if ſpared at Michaelmas it will grow all winter.

Mr Peacy's rye-graſs.

Dr Campbell of Lancaſter, in the eſſay already quoted, ſpeaks thus of the qualities of rye-graſs. "Upon looking back at the different opinions that have been given of this graſs, it is conceived, that they may be naturally accounted for. It has been tried in ſome ſituations, and found not to give a thick well-connected ſward. Rye-graſs is natural only to good ſoils, or thoſe in a fertile ſtate; for, however it may be found accidentally in thoſe of a contrary deſcription, it will be only where the land has been enriched by dung or other manure, caſually dropped. It comes up ſpontaneouſly for the moſt part by the road ſides, or near the gate of a paſture field where the cattle are accuſtomed to wait. The preſent ſummer a field was obſerved

Qualities of rye-graſs.

ſerved to be ſo full of rye-graſs, that, knowing none had been ſown in the country, it became a queſtion of curioſity to diſcover what circumſtances had occaſioned it. Upon inquiry, it turned out that a large quantity of cattle for a neighbouring fair, had been folded there a night, who had covered the field with their dung; whence the tendency to produce rye-graſs." Culture of Graſs.

"When land is in a proper ſtate of manure, rye-graſs, united with white clover, will form a perfect ſward the latter end of the ſecond year after it is ſown. I have a particular field of about five acres, that was ſown with theſe two graſſes only, that is more perfectly graſſed over than others which had the addition of trefoil and rib-graſs, and which were ſown at the ſame time.

"On converting rye-graſs into hay, it is neceſſary to cut it at a period previous to its being ſo ripe, as to have perfected its ſeed, and changed to a yellow colour; for in this caſe a great part of the juices of the plant, which conſtitute a principal part of the nutriment it is to afford, will be converted into a ſpecies of ſtraw, and its nutritive properties be proportionally diminiſhed.

"When it is made into hay, perſons not acquainted with its qualities are apt to object to its apparent coarſeneſs, which proceeds from its conſiſting almoſt entirely of flowering ſtems, the rye-graſs having comparatively a ſmaller proportion of leaves than any other graſs. Whether this be a defect or a merit, will depend upon a ſolution of this queſtion: Do the ſtems and flowering parts of graſs, or the leaves taken, weight for weight, contain the greater proportion of nutriment? It does not appear that this has been determined by experiments inſtituted for the purpoſe; but it ſeems probable from the ſtems being ſo much ſweeter than the

Culture of Graſs.

leaves, (which is particularly perceptible upon chewing them when about half dry), and from thoſe vegetables which contain much ſaccharine matter being particularly nutritious, that the greater proportional quantity of nutriment will be found to reſide in the ſtalks; and if ſo, the advantages of rye-graſs will be deciſive.

" But, however this may be, it is certain, that, ſuppoſing wet weather comes on during the proceſs of hay-making, the firſt part of the graſs that decays is the leaf, which ſoon becomes yellow, and then black; loſing all pretenſions to nutritive properties; in which caſe it is evident that almoſt the whole nutriment contained in the hay muſt reſide excluſively in the flowering ſtalks. Rye-graſs, then, has in unfavourable hay ſeaſons an advantage over all others, inaſmuch, as from having fewer leaves, it is not ſo apt to be injured by a continuance of rain, and it is beſides, when in the cocks, more acceſſible to the air and wind, from lying more open and light; and conſequently not ſo apt to heat and mould as other graſſes in ſimilar ſituations and ſeaſons.

" It certainly poſſeſſes the following valuable properties: 1. That there are few graſſes ſo early in the ſpring. 2. That there are none better reliſhed by cattle, nor more nutritive. 3. That it has the power of reſiſting bad weather, in tickliſh hay ſeaſons, in a greater degree than other graſſes. 4. That there is a greater facility in collecting its ſeed than that of any other graſs.

" The prejudices againſt it appear to have ariſen, 1. From its having been ſown in land not capable of producing a full crop of any good vegetable. 2. From allowing it to ſhoot up ſo far as to have formed the ſeed in the flowering ſtalk, before cattle have been turned in-

to

to paſture, or that it has been cut for hay. Rye-graſs appears to partake more of the nature of grain than any other graſs. Hence, when it has perfected its ſeeds, it ſhoots out no more ſtalks and but few leaves that ſeaſon, as Lord Kaimes has juſtly obſerved. Hence, it is neceſſary to turn cattle into a field of this graſs early in the ſpring, and to keep it well under by a ſufficient quantity of ſtock; in which caſe it will continue to put out freſh flowering ſtalks and leaves during the whole ſeaſon. 3. The hay, for the reaſon juſt aſſigned, ſhould be cut before it becomes a mere ſtraw. Common hay-graſs, being compoſed of graſs in various ſtages of growth and ripeneſs, admits of a greater latitude than a field of rye-graſs, becauſe many of them will generally be in a proper ſtate for cutting, although others may have paſſed their prime." Culture of Graſs.

No plant ought to be mixed with rye-graſs that is intended for ſeed. In Scotland, much rye-graſs ſeed is ſpoiled by tranſgreſſing that rule. The ſeed is ripe when it parts eaſily with the huſk. The yellowneſs of the ſtem is another indication of its ripeneſs; in which particular it reſembles oats, barley, and other culmiferous plants. The beſt manner to manage a crop of rye-graſs for ſeed, is to bind it looſely in ſmall ſheaves, widening them at the bottom to make them ſtand erect; as is done with the oats in moiſt weather. In that ſtate they may ſtand till ſufficiently dry for thraſhing. By this method they dry more quickly, and are leſs hurt by rain, than by cloſe binding and putting the ſheaves in ſhocks like corn. The worſt way of all is to ſpread the rye-graſs on the moiſt ground, for it makes the ſeed malten. The ſheaves, when ſufficiently dry, are carried in cloſe carts to where they How to manage it for ſeed.

are

Culture of Graſs.

are to be thraſhed on a board, as mentioned above for clover. Put the ſtraw in a rick when a hundred ſtone weight or ſo is thraſhed. Carry the thraſhing board to the place where another rick is intended; and ſo on till the whole ſeed be thraſhed, and the ſtraw ricked. There is neceſſity for cloſe carts to ſave the ſeed, which is apt to drop out in a hot ſun; and, as obſerved above, a hot ſun ought always to be choſen for thraſhing. Carry the ſeed in ſacks to the granary or barn, there to be ſeparated from the huſks by a fanner. Spread the ſeed thin upon a timber floor, and turn it once or twice a-day till perfectly dry. If ſuffered to take a heat, it is uſeleſs for ſeed.

Rib-graſs.

Rib-graſs *(plantago lanceolata)*. Upon rich ſands and loams this plant gives a conſiderable herbage; and on poorer and drier ſoils it does well for ſheep, but it is inferior to ſome others. Mr Marſhal obſerves, that it has ſtood the teſt of twenty years eſtabliſhed practice in Yorkſhire, and is in good eſtimation; though not well affected by horſes, and bad for hay, from retaining its ſap. The eminent Haller informs us, that the aſtoniſhing richneſs of the famous dairies of the Alps, deſcribed by Scheuhzer, is attributed entirely to the plenty of this plant and the *alchemilla vulgaris*. The ſeed is always plentiful.

Culture of ſainfoin.

The writers on agriculture reckon ſainfoin preferable to clover in many reſpects: They ſay, that it produces a larger crop; that it does not hurt cattle when eaten green; that it makes better hay; that it continues four times longer in the ground; and that it will grow on land that will bear no other crop.

Sainfoin has a very long tap-root, which is able to pierce very hard earth. The roots grow very large; and

and the larger they are, they penetrate to the greater depth; and hence it may be concluded, that this graſs, when it thrives well, receives a great part of its nouriſhment from below the *ſtaple* of the ſoil: of courſe, a deep dry ſoil is beſt for the culture of ſainfoin. When plants draw their nouriſhment from that part of the ſoil that is near the ſurface, it is not of much conſequence whether their number be great or ſmall. But the caſe is very different when the plants receive their food, not only near, but alſo deep below, the ſurface. Beſides, plants that ſhoot their roots deep are often ſupplied with moiſture, when thoſe near the ſurface are parched with drought. Culture of Graſs.

To render the plants of ſainfoin vigorous, it is neceſſary that they be ſown thin. The beſt method of doing this is by a drill; becauſe, when ſown in this manner, not only the weeds, but alſo the ſupernumerary plants, can eaſily be removed. It is ſeveral years before ſainfoin comes to its full ſtrength; and the number of plants ſufficient to ſtock a field, while in this imperfect ſtate, will make but a poor crop for the firſt year or two. It is therefore neceſſary that it be ſown in ſuch a manner as to make it eaſy to take up plants in ſuch numbers, and in ſuch order, as always to leave in the field the proper number in their proper places. This can only be done, with propriety, by ſowing the plants in rows by a drill. Suppoſing a field to be drilled in rows at ten inches diſtance, the partitions may be hand-hoed, and the rows dreſſed in ſuch a manner as to leave a proper number of plants. In this ſituation the field may remain two years; then one-fourth of the rows may be taken out in pairs, in ſuch a manner as to make the beds of fifty inches, with ſix

rows

Culture of Grafs.

rows in each, and intervals of thirty inches, which may be ploughed. Next year, another fourth of the rows may be taken out in the ſame manner, ſo as to leave double rows with partitions of ten inches, and intervals of thirty: All of which may be hoed at once or alternately, as it may be found moſt convenient.

The great quantity of this graſs which the writers on this ſubject aſſure us may be raiſed upon an acre, and the excellency and great value of the hay made of it, ſhould induce farmers to make a complete trial of it, and even to uſe the ſpade in place of the hoe, or hoe-plough, if neceſſary.

Mode of tranſplanting.

The plants taken up from a field of ſainfoin may be ſet in another field; and if the tranſplanting of this graſs ſucceeds as well as the tranſplanting of lucerne has done with M. Lunin de Chateauvieux, the trouble and expence will be ſufficiently recompenſed by the largeneſs of the crops. In tranſplanting, it is neceſſary to cut off great part of the long tap-root: this will prevent it from ſtriking very deep into the ſoil, and make it puſh out large roots in a ſloping direction from the cut end of the tap-root. Sainfoin managed in this manner, will thrive even on ſhallow land that has a wet bottom, provided it be not overſtocked with plants.

Whoever inclines to try the culture of this graſs in Scotland, ſhould take great pains in preparing the land, and making it as free from weeds as poſſible.

In England, as the roots ſtrike deep in that chalky ſoil, this plant is not liable to be ſo much injured by drought as other graſſes are, whoſe fibres ſtrike horizontally, and lie near the ſurface. The quantity of hay produced is greater and better in quality than any other.

But

But there is one advantage attending this graſs, which renders it ſuperior to any other; and that ariſes from feeding with it milch cows. The prodigious increaſe of milk which it makes is aſtoniſhing, being nearly double that produced by any other green food. The milk is alſo better, and yields more cream than any other; and the butter procured from it is much better coloured and flavoured. Culture of Graſs.

The following remarks by an Engliſh farmer are made from much experience and obſervation.

Sainfoin is much cultivated in thoſe parts where the ſoil is of a chalky kind. It will always ſucceed well where the roots run deep; the worſt ſoil of all for it is where there is a bed of cold wet clay, which the tender fibres cannot penetrate. This plant will make a greater increaſe of produce, by at leaſt 30 times, than common graſs or turf on poor land. Where it meets with chalk or ſtone, it will extend its roots through the cracks and chinks to a very great depth in ſearch of nouriſhment. The dryneſs is of more conſequence than the richneſs of land for ſainfoin; although land that is both dry and rich will always produce the largeſt crops. Remarks on the culture of ſainfoin in England

It is very commonly ſown broad-caſt; but it is found to anſwer beſt in drills, eſpecially if the land be made fine by repeated ploughing, rolling, and harrowing. Much depends on the depth at which this ſeed is ſown. If it be buried more than an inch deep, it will ſeldom grow; and if left uncovered, it will puſh out its roots above ground, and theſe will be killed by the air. March and the beginning of April are the beſt ſeaſons for ſowing it, as the ſeverity of winter and the drought of ſummer are equally unfavourable to the young plants.

Culture of Graſs. A buſhel of ſeed ſown broad-caſt, or half that quantity in drills, if good, is ſufficient for an acre. The drills ſhould be 30 inches apart, to admit of horſe-hoeing between them. Much, however, depends on the goodneſs of the ſeed, which may be beſt judged of by the following marks:

The huſk ought to be of a bright colour, the kernel plump, of a gray or bluiſh colour without, and if cut acroſs, greeniſh and freſh withinſide; if it be thin and furrowed, and of a yellowiſh caſt, it will ſeldom grow. When the plants ſtand ſingle, and have room to ſpread, they produce the greateſt quantity of herbage, and the ſeed ripens beſt. But farmers in general, from a miſtaken notion of all that appears to be waſte ground being unprofitable, plant them ſo cloſe, that they choke and impoveriſh each other, and often die in a few years. Single plants run deepeſt and draw moſt nouriſhment; they are alſo eaſieſt kept free from weeds. A ſingle plant will often produce half a pound of hay, when dry. On rich land this plant will yield two good crops in a year, with a moderate ſhare of culture. A good crop muſt not be expected the firſt year: but if the plants ſtand not too thick, they will increaſe in ſize the ſecond year prodigiouſly.

No cattle ſhould be turned on the field the firſt winter after the corn is off with which it was ſown, as their feet will injure the young plants. Sheep ſhould not come on the following ſummer, becauſe they would bite off the crown of the plants, and prevent their ſhooting again. A ſmall quantity of ſoapers aſhes as a top-dreſſing will be of great ſervice, if laid on the firſt winter.

If the ſainfoin be cut juſt before it comes to bloom,

it

it is admirable food for horned cattle; and if cut thus early, it will yield a ſecond crop the ſame ſeaſon. But if it proves a wet ſeaſon, it is better to let it ſtand till its bloom be perfected; for great care muſt be taken, in making it into hay, that the flowers do not drop off, as cows are very fond of them; and it requires more time than any other hay in drying. Sainfoin is ſo excellent a fodder for horſes, that they require no oats while they eat it, although they be worked hard all the time. Sheep will alſo be fattened with it faſter than with any other food. Culture of Graſs.

If the whole ſeaſon for cutting proves very rainy, it is better to let the crop ſtand for ſeed, as that will amply repay the loſs of the hay; becauſe it will not only fetch a good price, but a peck of it will go as far as a peck and a half of oats for horſes.

The beſt time of cutting the ſeeded ſainfoin is, when the greateſt part of the ſeed is well filled, the firſt blown ripe, and the laſt blown beginning to open. For want of this care ſome people have loſt moſt of their ſeed by letting it ſtand to ripe. Seeded ſainfoin ſhould always be cut in the morning or evening, when the dews render the ſtalks tender. If cut when the ſun ſhines hot, much of the ſeed will fall out and be loſt.

An acre of very ordinary land, when improved by this graſs, will maintain four cows very well from the firſt of April to the end of November; and afford, beſides, a ſufficient ſtore of hay to make the greater part of their food the four months following. Number of cattle it will maintain.

If the ſoil be tolerably good, a field of ſainfoin will laſt from 15 to 20 years in prime; but at the end of ſeven or eight years, it will be neceſſary to lay on a moderate

Culture of Grafs.

moderate coat of well-rotted dung; or, if the ſoil be very light and ſandy, of marl. By this means the future crops, and the duration of the plants in health and vigour, will be greatly increaſed and prolonged. Hence it will appear, that for poor land there is nothing equal to this graſs in point of advantage to the farmer.

Clover will laſt only two years in perfection; and often, if the ſoil be cold and moiſt, near half the plants will rot, and bald patches be found in every part of the field the ſecond year. Beſides, from our frequent rains during the month of September, many crops left for feeding are loſt. But from the quantity and excellent quality of this graſs (ſainfoin), and its ripening earlier, and continuing in vigour ſo much longer, much riſk and certain expence are avoided, and a large annual profit accrues to the farmer.

Culture of lucerne.

The writers on agriculture, ancient as well as modern, beſtow the higheſt encomiums upon lucerne as affording excellent hay, and producing very large crops. Lucerne remains at leaſt 10 or 12 years in the ground, and produces about eight tons of hay upon the Scots acre. There is but little of it cultivated in Scotland. However, it has been tried in ſeveral parts of that country; and it is found, that, when the ſeed is good, it comes up very well, and ſtands the winter froſt. But the chief objection to this graſs in Scotland, has been the difficulty of keeping the ſoil open and free from weeds. This cannot be done effectually by any other means than horſe-hoeing; and accordingly this method was firſt propoſed by Mr Tull, and afterwards practiſed ſucceſsfully by M. de Chateauvieux near Geneva. It

may

may be of uſe therefore to give a view of that gentleman's method of cultivating lucerne. Culture of Graſs.

He does not mention any thing particular as to the manner of preparing the land; but only obſerves, in general, that no pains ſhould be ſpared in preparing it. He tried the ſowing of lucerne both in rows upon the beds where it was intended to ſtand; likewiſe the ſowing it in a nurſery, and afterwards tranſplanting it into the beds prepared for it. He prefers tranſplanting; becauſe, when tranſplanted, part of the tap-root is cut off, and the plant ſhoots out a number of lateral branches from the cut part of the root, which makes it ſpread its roots nearer the ſurface, and conſequently renders it more eaſily cultivated: beſides, this circumſtance adapts it to a ſhallow ſoil, in which, if left in its natural ſtate, it would not grow.

The tranſplanting of lucerne is attended with many advantages. The land may be prepared in the ſummer for receiving the plants from the nurſery in autumn; by which means the field muſt be in a much better ſituation than if the ſeed had been ſown upon it in the ſpring. By tranſplanting, the rows can be made more regular, and the intended diſtances more exactly obſerved; and conſequently the hoeing can be performed more perfectly, and with leſs expence. M. Chateauvieux likewiſe tried the lucerne in ſingle beds three feet wide, with ſingle rows; in beds three feet nine inches wide, with double rows; and in beds four feet three inches wide, with triple rows. The plants in the ſingle rows were ſix inches aſunder, and thoſe in the double and triple rows were about eight or nine inches. In a courſe of three years he found, that a ſingle row produced more than a triple row of the ſame Tranſplanting.

Culture of Grass.

length. The plants of lucerne, when cultivated by transplantation, ſhould be at leaſt ſix inches aſunder, to allow them room for extending their crowns.

He further obſerves, that the beds or ridges ought to be raiſed in the middle; that a ſmall trench, two or three inches deep, ſhould be drawn in the middle; and that the plants ought to be ſet in this trench, covered with earth up to the neck. He ſays, that if the lucerne be ſown in ſpring, and in a warm ſoil, it will be ready for tranſplanting in September; that, if the weather be too hot and dry, the tranſplanting ſhould be delayed till October; and that, if the weather be unfavourable during both theſe months, this operation muſt be delayed till ſpring. He further directs, that the plants ſhould be carefully taken out of the nurſery, ſo as not to damage the roots; that the roots be left only about ſix or ſeven inches long; that the green crops be cut off within about two inches of the crown; that they be put into water as ſoon as taken up, there to remain till they are planted; and that they ſhould be planted with a planting ſtick, in the ſame manner as cabbages.

He does not give particular directions as to the times of horſe-hoeing; but only ſays, in general, that the intervals ſhould be ſtirred once in the month during the whole time that the lucerne is in a growing ſtate. He likewiſe obſerves, that great care ought to be taken not to ſuffer any weeds to grow among the plants, at leaſt for the firſt two or three years; and for this purpoſe, that the rows, as well as the edges of the intervals where the plough cannot go, ſhould be weeded by the hand.

Mr Young obſerves that the culture of this plant is

one

one of the principal features of French huſbandry. Culture of Graſs.
" We have gone, ſays he *, to the French ſchool for the culture of it; yet it is ill managed, and with bad ſucceſs, in England, and has been ſo in every period: but in France, even in climates ſimilar to our own, it is an object of almoſt uniform profit: and it muſt therefore be unfortunate indeed, if we do not extract ſomething from the French practice deſerving our attention and imitation. The firſt leading circumſtance that demands our attention, is the unvarying practice of ſowing it broadcaſt. The lucerne in Spain, which is of a luxuriance we have no conception of, and the little I have ſeen in Italy, is all ſown in the ſame way. A contrary practice, namely, that of drilling, has taken place in England. It has been repeatedly urged, that the humidity of our climate renders hoeing neceſſary, to keep it free from the ſpontaneous graſſes; and if hoeing is neceſſary, drilling is certainly ſo. But this neceſſity is not found to take place in the north of France, the climate of which very nearly reſembles our own. After ſome years thoſe graſſes deſtroy it there as well as here; but the French think it much more profitable when that happens to plough it up, than to enſure a longer poſſeſſion by perpetual expence and attention. Mr Young on the French culture.

" A Frenchman from Provence (Rocque) introduced this broadcaſt culture of lucerne, about 25 years ago, into England. I ſaw his crops, which were very fine, and equal to any in the north of France. Mr Arbuthnot of Mitcham had it alſo on the ſame method on a

* *Travels* vol. i.

Culture of Grafs.

large ſcale, and with conſiderable ſucceſs: other perſons have ſucceeded equally well, whoſe experiments may be found in the regiſters of my agricultural tours through England; the method, however, has not been generally purſued, and the little lucerne to be found in England is chiefly in drills. It certainly deſerves inquiry, whether this is not the reaſon of the cultivation at large not having made a greater progreſs with us. The introduction of hoes and horſe-hoes among crops that are cleared but once a-year from the land, and with no neceſſity of mowing them cloſe to the ground, appears to be much eaſier, and more practicable, than hoeing and horſe-hoeing a meadow cut and cleared thrice in a year, and which muſt of neceſſity be mown quite cloſely. The broadcaſt ſucceeds well in every part of France in proportion to the goodneſs of the ſoil and the management, like every other crop."

Previous crop.

This author ſuggeſts, that a turnip or cabbage crop is the right preparation. If the field be foul the crop ought to be repeated, and during both years it ought to be fed on the land: The lucerne ought then to be ſown at the rate of two buſhels per Engliſh acre, along with barley or oats. Should weeds appear the firſt year, an expence of 10s. per acre ought to be laid out in drawing or otherwiſe extirpating them, and after that the lucerne ſhould take its chance. No manure ſhould be allowed till the crop is two years old. Its ameliorating effect upon the ſoil is very great.

Burnet.

Burnet (*poterium ſanguiſorba*) is peculiarly adapted to poor land; beſides, it proves an excellent winter paſture when hardly any thing elſe vegetates. Other advantages are, It makes good butter; it never blows or ſwells cattle; it is fine paſture for ſheep; and will flouriſh

riſh well on poor, light, ſandy, or ſtony ſoils, or even on dry chalk hills. Culture of Graſs.

The cultivation of it is neither hazardous nor expenſive. If the land is prepared as is generally done for turnips, there is no danger of its failing. After the firſt year, it will be attended with very little expence, as the flat circular ſpread of its leaves will keep down, or prevent the growth of weeds. Culture of burnet.

On the failure of turnips, either from the fly or the black worm, ſome of our farmers have ſown the land with burnet, and in March following had a fine paſture for their ſheep and lambs. It will perfect its ſeed twice in a ſummer; and this ſeed is ſaid to be as good as oats for horſes; but it is too valuable to be applied to that uſe.

It is ſometimes ſown late in the ſpring with oats and barley, and ſucceeds very well; but it is beſt to ſow it ſingly in the beginning of July, when there is a proſpect of rain, on a ſmall piece of land, and in October following tranſplant it in rows two feet apart, and about a foot diſtant in the rows. This is a proper diſtance, and gives opportunity for hoeing the intervals in the ſucceeding ſpring and ſummer.

After it is fed down with cattle, it ſhould be harrowed clean. Some horſes will not eat it freely at firſt, but in two or three days they are generally very fond of it. It affords rich pleaſant milk, and in great plenty.

A gentleman farmer near Maidſtone, ſome years ſince, ſowed four acres as ſoon as the crop of oats was got off, which was the latter end of Auguſt. He threw in 12 pounds of ſeed per acre, broad-caſt; and no rain falling until the middle of September, the plants did not appear before the latter end of that month.

Culture of Graſs.

There was however a good crop; and in the ſpring he ſet the plants out with a turnip hoe, leaving them about a foot diſtant from each other. But the drill method is preferable, as it ſaves more than half the ſeed. The land was a poor dry gravel, not worth three ſhillings an acre for any thing elſe.

The ſevereſt froſt never injures this plant; and the oftener it is fed the thicker are its leaves, which ſpring conſtantly from its root.

Reſts froſt and cloſe feeding.

There are large tracts of the fineſt parts, of what are called the *South Downs* in England, upon which this plant forms half the indigenous paſturage. It abounds alſo much in that country on all other chalk downs, though it will flouriſh as already mentioned on poor land, as ſand, clay, peat, &c.

We ſhall here enumerate a few more of the graſſes which have been accounted valuable, or are likely to become ſo, requeſting the reader at the ſame time to look back to what we have already ſtated upon the ſubject, when diſcuſſing the kinds of vegetables proper to be raiſed for feeding cattle.

Bulbous foxtail-graſs.

Alopecurus bulboſus, (bulbous foxtail-graſs), is recommended by Dr Anderſon *, as promiſing on ſome occaſions to afford a valuable paſture-graſs. It ſeems chiefly, he obſerves, to delight in a moiſt ſoil, and therefore promiſes to be only fit for a low paſture-graſs. The quality that firſt recommended it to his notice, was the unuſual firmneſs that its matted roots gave to the ſurface of the ground, naturally ſoft and moiſt, in which it grew; which ſeemed to promiſe that it might be of uſe

* *Eſſays on Agriculture, &c.*

uſe upon ſuch ſoils, chiefly in preventing them from being much poached by the feet of cattle which might paſture upon them. Moſſy ſoils eſpecially are ſo much hurt by poaching, that any thing that promiſes to be of uſe in preventing it deſerves to be attended to. Culture of Graſs.

Poa pratenſis, (great meadow-graſs), ſeems to approach in many reſpects to the nature of the purple feſcue; only that its leaves are broader, and not near ſo long, being only about a foot or 16 inches at their greateſt length. Like it, it produces few ſeed-ſtalks and many leaves, and is an abiding plant. It affects chiefly the dry parts of meadows, though it is to be found on moſt good paſtures. It is very retentive of its ſeeds, and may therefore be ſuffered to remain till the ſtalks are quite dry. It bloſſoms the beginning of June, and its ſeeds are ripe in July. Great meadow-graſs.

Poa compreſſa, (creeping meadow-graſs), according to Dr Anderſon, ſeems to be the moſt valuable graſs of any of this genus. Its leaves are firm and ſucculent, of a dark Saxon-green colour; and grow ſo cloſe upon one another, as to form the richeſt pile of paſture-graſs. The flower-ſtalks, if ſuffered to grow, appear in ſufficient quantities; but the growth of theſe does not prevent the growth of the leaves, both advancing together during the whole ſummer; and when the ſtalks fade, the leaves continue as green as before. Its leaves are much larger and more abundant than the common meadow-graſs, (*poa trivialis*); and therefore it better deſerves to be cultivated. Creeping meadow-graſs.

Anthoxanthum odoratum, (vernal graſs), grows very commonly on dry hills, and likewiſe on ſound rich meadow-land. It is one of the earlieſt graſſes we have; and from its being found on ſuch kinds of paſtures as Vernal graſs.

Culture of Graſs.

ſheep are fond of, and from whence excellent mutton comes, it is moſt likely to be a good graſs for ſheep paſtures. It gives a grateful odour to hay. In one reſpect, it is very eaſy to gather, as it ſheds its ſeeds upon the leaſt rubbing. A correſpondent of the Bath Society, however, mentions a difficulty that occurs in collecting them, owing to its being ſurrounded with other graſſes at the time of its ripening, and being almoſt hid among them. If it be not carefully watched when nearly ripe, he obſerves, and gathered within a few days after it comes to maturity, great part of the ſeed will be loſt. The twiſted elaſtic awns, which adhere to the ſeed, lift them out of their receptacles with the leaſt motion from the wind, even while the ſtraw and ear remain quite erect. It is found moſtly in the moiſt parts of meadows; very little of it on dry paſtures. It flowers about the beginning of May, and is ripe about the middle of June.

Creſted dog's-tail graſs.

Cynoſurus criſtatus, (creſted dog's-tail graſs). Mr Stillingfleet imagines this graſs to be proper for parks, from his having known one, where it abounds, that is famous for excellent veniſon. He recommends it alſo, from experience, as good for ſheep; the beſt mutton he ever taſted, next to that which comes from hills where the purple and ſheep's feſcue, the fine bent, and the ſilver hair-graſſes abound, having been from ſheep fed with it. He adds, that it makes a very fine turf upon dry ſandy or chalky ſoils: but unleſs ſwept over with the ſcythe, its flowering ſtems will look brown; which is the caſe of all graſſes which are not fed on by variety of animals. For that ſome animals will eat the flowering ſtems is evident from commons, where ſcarcely any parts of graſſes appear but the radical leaves. This

graſs

graſs is ſaid to be the eaſieſt of the whole group to collect a quantity of ſeed from. It flowers in June, and is ripe in July. Culture of Graſs.

The Rev. Mr Arthur Young obſerves, that "to judge from the appearance of the bents of this graſs in poor upland but moiſt paſtures, a man would think it a very unpromiſing plant; but the rich marſhes of Bridgewater and Boſton, the famous paſturages of Paniton in Devonſhire, and thoſe cloſe to Mr Buller's caſtle near Leſkeard in Cornwall, Mr Thorne's bullock-grounds on Dunſtone bottom, near Taviſtock, Mrs Williams's at Little Malvern in Worceſterſhire (which are among the richeſt paſtures in the kingdom), all abound very greatly in this graſs: in ſome of them it is the predominant herbage. Mr Marſhal places it as the moſt prevailing plant in the beſt graſs meadows of the vale of Pickering, ſome of which will feed a large cow from Mayday to Michaelmas. Very fortunately it abounds much with ſeed, ſo that I have had many buſhels gathered in a ſeaſon by poor women and children at 1s. a pound, and laid down many acres with it ſucceſsfully. Attention ſhould be paid to its being ripe; for I once ordered eight buſhels to be ſown on eight acres, and it failed from a deficiency in ripeneſs."

Stipa pennata, (cock's-tail, or feather graſs.) Cock's-tail or feather graſs.

Agroſtis capillaris (fine bent), is recommended by Mr Stillingfleet, from his having always found it in great plenty on the beſt ſheep paſtures, in the different counties of England that are remarkable for good mutton. This graſs flowers and ripens its ſeed the lateſt of them all. It ſeems to be loſt the former part of the year, but vegetates luxuriantly towards the autumn. It appears to be fond of moiſt ground. It retains its ſeed Fine bent.

till

Culture of grass. till full ripe; flowers the latter end of July, and is ripe the latter end of Auguſt.

Mountain hair. *Aira flexuoſa*, (mountain hair.)

Silver hair. —— *caryophillea*, (ſilver hair.)

The ſame may be ſaid of theſe two graſſes as of the preceding one.

Flote feſcue. *Feſtuca fluitans*, (flote feſcue.) In a pre- liſhed in the Amœnitates Academicæ, vol. iii. entitled *Plantæ Eſculentæ*, we are informed, that "the ſeeds of this graſs are gathered yearly in Poland, and from thence carried into Germany, and ſometimes into Sweden, and ſold under the name of *manna ſeeds*.—Theſe are much uſed at the tables of the great, on account of their nouriſhing quality and agreeable taſte. It is wonderful (adds the author), that amongſt us theſe ſeeds have hitherto been neglected, ſince they are ſo eaſily collected and cleanſed." There is a clammineſs on the ear of the flote feſcue, when the ſeeds are ripe, that taſtes like honey; and for this reaſon perhaps they are called *manna ſeeds*.

Linnæus (*Flor. Suec.* art. 95.) ſays that the bran of this graſs will cure horſes troubled with botts, if kept from drinking for ſome hours.

Concerning this graſs we have the following information by Mr Stillingfleet. "Mr Dean, a very ſen- ſible farmer at Ruſcomb, Berkſhire, aſſured me that a field, always lying under water, of about four acres, that was occupied by his father when he was a boy, was covered with a kind of graſs, that maintained five farm horſes in good heart from April to the end of harveſt, without giving them any other kind of food, and that it yielded more that they could eat. He, at my deſire, brought me ſome of the graſs, which pro-

ved

ed to be the flote feſcue with a mixture of the marſh- Culture of Graſs.
bent; whether this laſt contributes much towards furniſhing ſo good paſture for horſes, I cannot ſay. They both throw out roots at the joints of the ſtalks, and therefore likely to grow to a great length. In the index of dubious plants at the end of Ray's Synopſis, there is mention made of a graſs, under the name of *gramen caninum ſupinum longiſſimum*, growing not far from Saliſbury, 24 feet long. This muſt by its length be a graſs with a creeping ſtalk; and that there is a graſs in Wiltſhire growing in watery meadows, ſo valuable that an acre of it lets from 10l. to 12l. I have been informed by ſeveral perſons. Theſe circumſtances incline me to think it muſt be the flote feſcue; but whatever graſs it be, it certainly muſt deſerve to be inquired after."

Alopecurus pratenſis, (meadow foxtail.) Linnæus ſays Meadow foxtail.
that this is a proper graſs to ſow on grounds that have been drained. Mr Stillingfleet was informed, that the beſt hay which comes to London is from the meadows where this graſs abounds. It is ſcarce in many parts of England, particularly Herefordſhire, Berkſhire, and Norfolk. It might be gathered at almoſt any time of the year from the hay-rick, as it does not ſhed its ſeeds without rubbing, which is the caſe of but few graſſes. It is among the moſt uſeful of all graſſes to cattle. It is ripe about the latter end of June.

The Rev. Mr Young remarks, that "for moiſt loams and clays, there cannot be a better graſs; it is very early, it abides on this farm often nine or ten years on the ſoils upon which the meadow feſcue gives way to others; it has alſo been found by Mr Majendie hardier againſt froſts than the *poa trivialis*; the greateſt objection

Culture of Grafs.

jection to it is the difficulty of getting the ſeed in any degree of plenty; there is an inſect that feeds on it, and occaſions much diſappointment. Mr Profeſſor Martyn, in his excellent *Flora Ruſtica*, ſpeaks highly of this graſs, and ſays, the ſeeds may be collected without much difficulty; but he does not there adver to the inſect which is ſo pernicious, noticed by Mr Majendie, and the ingenious Mr Swayne in his *Examina Paſcua*. In a field on this farm, where it is very well eſtabliſhed, and the herbage thick, it produces very few ſeed-ſtalks."

Poa trivialis *Poa trivialis*.—Mr Boys of Betſhanger in Kent, has been the largeſt cultivator of this graſs in the kingdom, and ſold large quantities of the ſeed; but gave it up for want of a demand. It is an excellent graſs on good and ſound and moiſt loams. It is accounted in Lombardy, "the queen of meadow plants (*la regina dell' erbe,*) for dry paſtures or water meadows; multiplying itſelf much by ſeed, and little by the root; ſo that if attention be not paid to permit ſome ſeed to fall, its quantity will ſenſibly diminiſh. Excellent for all ſorts of cattle."

"This hint concerning the ſeed is worth attention in England. Major Cartwright has found the *poa pratenſis* to be an excellent graſs on rich loams; and both ſucceeded well with Sir William Clayton of Harleyford.

"Trefoil (*medicago lupulina*), though only a biennial, is ſure to ſhed ſo much ſeed, that it rarely wears out of land. It is a good plant, not at all nice in ſoil, and ſeed cheap.

Cow-graſs. "Cow-graſs (*trifolium medium*), is an excellent plant for clays and ſtrong loams. It is ſaid, in the Lincoln Report, that Mr Ancel got good crops on a rabbit ſand; the hint is worth purſuing. It is much more

abiding

abiding than common clover. The ſeed is always to be had; it is known alſo under the name of marle graſs." Culture of Graſs.

Poa annua, (annual meadow-graſs). "This graſs (ſays Mr Stillingfleet) makes the fineſt of turfs. It grows everywhere by way ſides, and on rich ſound ground. It is called in ſome parts the *Suffolk-graſs*. I have ſeen whole fields of it in High Suffolk without any mixture of other graſſes; and as ſome of the beſt ſalt butter we have in London comes from that country, it is moſt likely to be the beſt graſs for the dairy. I have ſeen a whole park in Suffolk covered with this graſs; but whether it affords good veniſon, I cannot tell, having never taſted of any from it. I ſhould rather think not, and that the beſt paſture for ſheep is alſo the beſt for deer. However, this wants trial. I remarked on Malvern-hill ſomething particular in relation to this graſs. A walk that was made there for the convenience of the water-drinkers, in leſs than a year was covered in many places with it, though I could not find one ſingle plant of it beſides in any part of the hill. This was no doubt owing to the frequent treading, which above all things makes this graſs flouriſh; and therefore it is evident that rolling muſt be very ſerviceable to it. It has been objected, that this graſs is not free from *bents*, by which word is meant the flowering-ſtems. I anſwer, that this is moſt certainly true, and that there is no graſs without them. But the flowers and ſtems do not grow ſo ſoon brown as thoſe of other graſſes; and being much ſhorter, they do not cover the radical leaves ſo much; and therefore this graſs affords a more agreeable turf without mowing than any other whatever that I know of." The ſeeds of this ſpecies Annual meadow-graſs.

Culture of Graſs.

cies drop off before they are dry, and, to appearance, before they are ripe. The utmoſt care is therefore neceſſary in gathering the blades, without which very few of the ſeeds will be ſaved. It ripens from the middle of April, to ſo late, it is believed, as the end of October; but moſtly diſappears in the middle of the ſummer. It grows in any ſoil and ſituation, but rather affects the ſhade.

Agroſtis cornucopiæ.

A new graſs from America (named *agroſtis cornucopiæ*), was ſome time ago much advertiſed and extolled, as poſſeſſing the moſt wonderful qualities, and the ſeeds of it were ſold at the enormous rate of 68l. the buſhel. But we have not heard that it has at all anſwered expectation. On the contrary, we are informed by Dr Anderſon, in one of his publications *, that "it has upon trial been found to be good for nothing. Of the ſeeds ſown, few of them ever germinated: but enough of plants made their appearance, to aſcertain, that the graſs, in reſpect of quality, is amongſt the pooreſt of the tribe; and that it is an *annual* plant, and altogether unprofitable to the farmer."

Chicory.

Chicorium intybus, (chicory).

Mr Arthur Young has anxiouſly endeavoured to diffuſe a knowledge of this plant; and he appears to have been the firſt perſon that introduced it into the agriculture of England from France, where it grows naturally on the ſides of the roads and paths, and is ſometimes cultivated as a ſallad. When it has been ſown by itſelf, in ground prepared by good tillage, it has yielded two crops the ſame year. When ſown amongſt oats, no crop

* *Bee*, vol. i. p. 38.

crop is expected till the following year. This plant defies the greateſt droughts, and reſiſts every ſtorm. Being of very early growth, its firſt leaves, which are large and tufted, ſpread ſidewiſe, and cover the ground ſo as to retain the moiſture, and preſerve its roots from the heat, which ſo often dries up every other vegetable production: it has not any thing to fear from ſtorms, for its thick and ſtiff ſtalks ſupport themſelves againſt the winds and heavieſt rains. The moſt ſevere cold and froſts cannot injure it. The quickneſs of its growth, above all, renders it moſt valuable, becauſe it furniſhes an abundance of ſalutary fodder in a ſeaſon when the cattle, diſguſted with their dry winter food, greedily devour freſh plants. Culture of Graſs.

This plant is greedily eaten by all ſorts of cattle, but it is difficult to make into hay. It is very voluminous, and drys ill, unleſs the weather be very favourable for it. The dry fodder, however, which it does yield, is eaten with pleaſure by the cattle. The following is the reſult of an experiment made with it by Mr Young * upon an acre of ground

ſown April 1788.

	Green produce. Tons	cwt.
Cut July 24, - - -	9	10
October 17, - -	9	14
Produce of the year of ſowing,	19	4

1789.

* *Annals of Agriculture*, vol. xv.

Culture of Grafs.

	Green Produce. Tons.	Cwt.
1789. Cut May 21,	12	11
July 24,	16	4
December 3,	9	14
Produce of the fecond year,	38	9
1790. Cut June 8,	18	15
Auguft 15,	19	9
Produce of the third year,	38	4

The following Engliſh graſſes are recommended to attention by Mr Curtis, author of the *Flora Londinenſis*; and he has given directions for making experiments with graſs ſeeds in ſmall quantities.

Tall oat-graſs. "*Avena elatior*, (tall oat-graſs); common in wet meadows, and by the ſides of hedges, early, and very productive, but coarſe. Its ſeed might be had in any quantity from France.

Yellow oat-graſs. "*Avena flaveſcens*, (yellow oat-graſs); affects a dry ſoil, is early and productive, bids fair to make a good ſheep paſture.

Rough oat-graſs. "*Avena pubeſcens*, (rough oat-graſs); ſoil and ſituation nearly ſimilar to that of the meadow feſcue; hardy, early, and productive.

Upright broom-graſs. "*Bromus erectus*, (upright broom-graſs); peculiar to chalky ſoils; early and productive; promiſes to be a good graſs for chalky lands, and thrives indeed very well on others.

Blue dog's-tail. "*Cynoſurus cæruleus*, (blue dogs-tail graſs;) earlieſt of all the graſſes; grows naturally on the tops of the high-

eſt

eſt limeſtone rocks in the northern part of Great Britain: not very productive, yet may perhaps anſwer in certain ſituations, eſpecially as a graſs for ſheep: bears the drought of ſummer remarkably well: at all events ſeems more likely to anſwer than the ſheep's feſcue-graſs, on which ſuch encomiums have, moſt unjuſtly, been laviſhed. Culture of Graſs.

"*Dactylis glomeratus*, (rough cock's-foot graſs); a rough coarſe graſs, but extremely hard and productive: ſoil and ſituation the ſame as the meadow-feſcue. Rough cock's-foot graſs.

"*Feſtuca elatior*, (tall feſcue graſs); tall and coarſe, but very productive; affects wet ſituations. Tall feſcue graſs.

"*Feſtuca duriuſcula*, (hard feſcue graſs); affects ſuch ſituations as the ſmooth-ſtalked meadow graſs; is early and tolerably productive: its foliage is fine, and of a beautiful green; hence we have ſometimes thought it was of all others the fitteſt for a graſs-plat or bowling-green; but we have found, that though it thrives very much when firſt ſown or planted, it is apt to become thin, and die away after a while. Hard feſcue graſs.

"*Phleum pratenſe*, (meadow cats-tail graſs); affects wet ſituations; is very productive, but coarſe and late." Meadow cat's-tail graſs.

To ſow graſs ſeeds in ſmall quantities, this author gives the following directions:—

"If a piece of ground can be had, that is neither very moiſt nor very dry, it will anſwer for ſeveral ſorts of ſeeds: they may then be ſown on one ſpot; but if ſuch a piece cannot be obtained, they muſt be ſown on ſeparate ſpots according to their reſpective qualities, no matter whether in a garden, a nurſery, or a field, provided it be well ſecured and clean. Dig up the ground, level and rake it, then ſow each kind of ſeed thinly in a ſeparate row, each row about foot apart, Rules for making experiments with graſs-ſeeds.

Culture of Grafs.

and cover them over lightly with the earth; the latter end of Auguſt or beginning of September will be the moſt proper time for this buſineſs. If the weather be not uncommonly dry the ſeeds will quickly vegetate, and the only attention they will require will be to be carefully weeded. In about a fortnight from their coming up, ſuch of the plants as grow thickly together may be thinned, and thoſe which are taken up tranſplanted ſo as to make more rows of the ſame graſs.

" If the winter ſhould be very ſevere, though natives, as ſeedlings, they may receive injury; therefore it will not be amiſs to protect them with mats, fern, or by ſome other contrivance.

" Advantage ſhould be taken of the firſt dry weather in the ſpring, to roll or tread them down, in order to faſten their roots in the earth, which the froſt generally looſens: care muſt ſtill be taken to keep them perfectly clear from weeds. As the ſpring advances, many of them will throw up their flowering ſtems, and ſome of them will continue to do ſo all the ſummer. As the ſeed in each ſpike or panicle ripens, it muſt be very carefully gathered and ſown in the autumn, at which time the roots of the original plants, which will now bear ſeparating, ſhould be divided, and tranſplanted, ſo as to form more rows; the roots of the ſmooth-ſtalked meadow-graſs, in particular, creeping like couch-graſs, may readily be increaſed in this way; and thus by degrees a large plantation of theſe graſſes may be formed, and much ſeed collected.

" While the ſeeds are thus increaſing, the piece or pieces of ground, which are intended to be laid down, ſhould be got in order. If very foul, perhaps the beſt practice

practice (if paſture land) will be to pare off the ſward and burn it on the ground: or if this ſhould not be thought adviſable, it will be proper to plough up the ground and harrow it repeatedly, burning the roots of couch-graſs and other noxious plants, till the ground is become tolerably clean; to render it perfectly ſo, ſome cleanſing crop, as potatoes or turnips, ſhould be planted or ſown. Culture of Graſs.

" By this means, the ground we propoſe laying down will be got into excellent order without much loſs; and being now ready to form into a meadow or paſture, ſhould be ſown broad-caſt with the following compoſitions:

Meadow fox-tail, one pint;
Meadow feſcue, ditto;
Smooth-ſtalked meadow, half a pint;
Rough-ſtalked meadow, ditto;
Creſted dog's-tail, a quarter of a pint;
Sweet-ſcented vernal, ditto;
Dutch clover (trifolium repens), half a pint;
Wild red clover (trifolium pratenſe), or, in its ſtead,
Broad clover of the ſhops, ditto;
For wet land, the *creſted dog's-tail* and *ſmooth-ſtalked meadow* may be omitted, eſpecially the former.

" Such a compoſition as this, ſown in the proportion of about three buſhels to an acre on a ſuitable ſoil, in a favourable ſituation, will, I am bold to aſſert, form in two years a moſt excellent meadow; and, as all the plants ſown are ſtrong hardy perennials, they will not eaſily ſuffer their places to be uſurped by any noxious plants, which by manure or other means, in ſpite of all our endeavours, will be apt to inſinuate themſelves; if

Culture of Graſs.

they ſhould, they muſt be carefully extirpated; for ſuch a meadow is deſerving of the greateſt attention: but if that attention cannot be beſtowed on it, and in proceſs of time weeds ſhould predominate over the crop originally ſown, the whole ſhould be ploughed up, and freſh ſown with the ſame ſeeds, or with a better compoſition, if ſuch ſhall be diſcovered; for I have no doubt but at ſome future time, it will be as common to ſow a meadow with a compoſition ſomewhat like this, as it now is to ſow a field with wheat or barley.

As it is of much importance for the practical agriculturiſt to have under his eye, at one view, the kinds of graſſes beſt ſuited to particular ſoils, together with the quantities proper to be ſown upon a certain extent of land, we ſhall here ſtate, in his own words, the valuable remarks of the Rev. Mr A. Young upon theſe points.

"The graſs plants, ſays this author, may be thus arranged:

Clay	*Loam*	*Sand*	*Chalk*	*Peat*
Cow-graſs.	White clover.	White clover.	Yarrow.	White clover
Cocks-foot	Rye.	Rye.	Burnet.	Dogs-tail.
Dogs-tail.	York-white.	York white.	Trefoil.	Cocks-foot.
Feſcue.	Feſcue.	Yarrow.	White clover	Rib.
Fox-tail.	Fox-tail.	Burnet.	Sainfoin.	York white.
Oat-graſs.	Dogs-tail.	Trefoil.		Rye.
Trefoil.	Poa.	Rib.		Fox-tail.
York white.	Timothy.			Feſcue.
Timothy.	Yarrow.			Timothy.
	Lucern.			

However, with ſome latitude:—It may generally be received as a ſafe maxim, that the more ſeeds are ſown the

the better, provided inferior plants be not aſſigned to land that will produce better: thus, in the column of *loam*, *Yorkſhire white* ſhould not be ſown, provided the four following graſſes in the column can be had in quantity; which may not be the caſe. Culture of Graſs.

"There are many other plants, ſome of which have been tried under my direction, which deſerve much attention; but I have not named them in the above mentioned liſt, becauſe the ſeed cannot be procured but with difficulty; ſome perennial vetches, clovers, melilots, lotuſes, &c. Several others are highly ſpoken of by ſome writers; yet, as my own trials have not been equally ſucceſsful, I am not authorized to recommend them. I never tried the *vicia ſepium* ſufficiently to give an opinion of it; but by Mr Swayne's account it deſerves much attention. I do not think the Board of Agriculture could more eſſentially ſerve the public than by eſtabliſhing a farm, and cultivating theſe and other plants, for ſupplying ſeed to their members, who wiſhed to cultivate them; a very little land would be ſufficient.

"In regard to the quantities per acre of theſe plants, this muſt neceſſarily depend on the means of getting them. In ſituations where women and children are fully employed, it may be difficult to procure large quantities gathered by hand; in ſuch places a man muſt be content with what can be bought. *Creſted dog's-tail* is ſo very generally to be thus procured, that I cannot but ſuppoſe it, in a good meaſure, at command. However, without adverting to this point, I may remark, that from the lands which I have laid down to graſs to a conſiderable extent, and in which I have uſed every one of thoſe plants largely, except the poa, and

Culture of Graſs. that on a ſmaller ſcale I am inclined to think, that the following quantities may by ſafely recommended.

CLAY.

Seeds.	*Subſtitutes.*
Cow-graſs, 5 lbs.	
Trefoil, 5 lbs.	
Dog's-tail, 10 lbs.	Yorkſhire white 2 buſhels;
Feſcue, 1 buſhel;	Timothy, 4 lbs.
Fox-tail, 1 ditto;	Ditto, 4 lbs. Yorkſhire white, 1 buſhel.

LOAM.

White clover, 5 lbs.	
Dog's-tail, 10 lbs.	Rye, 1 peck;
Rye, 1 peck;	Rib-graſs, 4 lbs.
Feſcue, 3 ditto;	Yorkſhire white;
Fox-tail, 3 ditto;	Timothy, 4 lbs.
Yarrow, 2 ditto;	Cow-graſs, 5 lbs.

SAND.

White clover, 7 lbs.	
Trefoil, 5 lbs.	
Burnet, 6 lbs.	
Rye, 1 peck;	
Yarrow, 1 buſhel;	Rye, 1 peck; Rib, 4 lbs.

CHALK.

Burnet, 10 lbs.	
Trefoil, 5 lbs.	
White clover, 5 lbs.	
Yarrow, 1 buſhel;	Rye, 1 buſhel.

PEAT.

White clover, 10 lbs.	
Dogs-tail, 10 lbs.	York-white, 6 pecks;
Rye, 1 peck;	

fox-tail,

Seeds.	*Subſtitutes.*
Fox-tail, 2 pecks;	Rib, 5 lbs.
Feſcue, 2 pecks;	Cow-graſs, 4 lbs.
Timothy, 1 ditto.	

4. *Of the mode of improving Graſs Lands by flooding them artificially with water.*

One of the moſt important improvements in agriculture that has occurred of late years, is the practice of overflowing or flooding graſs lands, which is now coming greatly into uſe, not only on level grounds, but in all ſituations in which a command of water can be obtained. In the Monthly Review for October, 1788, the editors acknowledge the favour of a correſpondent, who informed them, that watering of meadows was practiſed during the reign of Queen Elizabeth and James I. A book was written upon the ſubject by one Rowland Vaughan, who ſeems to have been the inventor of this art, and who practiſed it on a very extenſive plan in the Golden Valley in Herefordſhire. Till this note to the Reviewers appeared, the inhabitants of a village called South Cerney in Glouceſterſhire had aſſumed the honour of the invention to themſelves, as we are informed in a treatiſe upon the ſubject by the Rev. Mr Wright curate of the place. According to a received tradition in that village, watering of meadows has been practiſed there for about a century, and was introduced by one *Welladviſe*, a wealthy farmer in South Cerney. His firſt experiment was by cutting a large ditch in the middle of his ground, from which he threw the water over ſome parts, and allowed it to ſtagnate in others: but finding this not to anſwer his expectations, he improved his method by

When the watering of meadows was firſt practiſed in England.

Culture of Graſs.

cutting drains and filling up the hollows; and thus he ſucceeded ſo well, that his neighbours, who at firſt called him a madman, ſoon changed their opinion, and began to imitate his example.

Advantages of watering.

The advantages which attend the watering of meadows are many and great; not only as excellent crops of graſs are thus raiſed, but as they appear ſo early, that they are of infinite ſervice to the farmers for food to their cattle in the ſpring before the natural graſs riſes. By watering we have plenty of graſs in the beginning of March, and even earlier when the ſeaſon is mild. The good effects of this kind of graſs upon all ſorts of cattle are likewiſe aſtoniſhing, eſpecially upon ſuch as have been hardly wintered; and Mr Wright informs us, that the farmers in his neighbourhood, by means of watering their lands, are enabled to begin the making of cheeſe at leaſt a month ſooner than their neighbours who have not the ſame advantage. Graſs raiſed by watering is found to be admirable for the nurture of lambs; not only thoſe deſigned for fattening, but ſuch as are to be kept for ſtore: For if lambs when very young are ſtopped and ſtinted in their growth, they not only become contracted for life themſelves, but in ſome meaſure communicate the ſame diminutive ſize to their young. The beſt remedy for preventing this evil is the ſpring feed from watered meadows; and Mr Wright is of opinion, that if the young of all kinds of farmer's ſtock were immediately encouraged by plenty of food, and kept continually in a growing ſtate, there would in a few years be a notable change both in the ſize and ſhape of cattle in general. Such indeed is the forwardneſs of graſs from watered meadows, that the feed between March

and

and May is worth a guinea per acre; and in June an acre will yield two tons of hay, and the after-math is always worth twenty ſhillings; and nearly the ſame quantity is conſtantly obtained whether the ſummer be dry or wet. In dry ſummers alſo, ſuch farmers as water their meadows have an opportunity of ſelling their hay almoſt at any price to their neighbours. Culture of Graſs.

Land treated in this manner is continually improving in quality, even though it be mown every year: the herbage, if coarſe at firſt, becomes finer; the ſoil, if ſwampy, becomes ſound; the depth of its mould is augmented, and its quality meliorated every year. Land conſtantly improves by watering. "To theſe advantages (ſays Mr Boſwell in his treatiſe upon this ſubject) another may be addreſſed to the gentleman who wiſhes to improve his eſtate, and whoſe benevolent heart prompts him to extend a charitable hand to the relief of the induſtrious poor, and not to idleneſs and vice: almoſt the whole of the expence in this mode of cultivation is the actual manual labour of a claſs of people who have no genius to employ their bodily ſtrength otherwiſe for their own ſupport and that of their families; conſequently when viewed in this light, the expence can be but comparatively ſmall, the improvement great and valuable."

As a proof of the above doctrine, Mr Wright adduces an inſtance of one year's produce of a meadow in his neighbourhood. Example of the produce of a watered meadow. It had been watered longer than the eldeſt perſon in the neighbourhood could remember; but was by no means the beſt meadow upon the ſtream, nor was the preceding winter favourable for watering. It contains ſix acres and a half. The ſpring feed was let for ſeven guineas, and ſupported near 200 ſheep from the 1ſt of March till the beginning

Culture of Graſs.

ning of May: the hay being ſold for 30 guineas, and the after-math for ſix. Another and ſtill more remarkable proof of the efficacy of watering is, that two of the moſt ſkilful watermen of that place were ſent to lay out a meadow of ſeven acres, the whole crop of which was that year ſold for two pounds. Though it was thought by many impoſſible to throw the water over it, yet the ſkill of the workmen ſoon overcame all difficulties; and ever ſince that time the meadow has been let at the rent of three pounds per acre. From manifold experience, our author informs us, that the people in that part of the country are ſo much attached to the practice of watering, that they never ſuffer the ſmalleſt ſpring or rivulet to be unemployed. Even thoſe temporary floods occaſioned by ſudden ſhowers are received into proper ditches, and ſpread equally over the lands until their fertilizing property be totally exhauſted. "Neceſſity (ſays he) indeed compels us to make the moſt of every drop: for we have near 300 acres in this pariſh, that muſt all, if poſſible, be watered; and the ſtream that affords the water ſeldom exceeds five yards in breadth and one in depth: therefore we may ſay, that a ſcarcity of water is almoſt as much dreaded by us as by the celebrated inhabitants of the banks of the Nile."

The practice of watering ought to be more generally extended.

Conſidering the great advantages to be derived from the practice of watering meadows, and the many undoubted teſtimonies in its favour, Mr Wright expreſſes his ſurpriſe, that it has not come into more general uſe, as there is not a ſtream of water upon which a mill can be erected but what may be made ſubſervient to the enriching of ſome land, perhaps to a great quantity. "I am confident (ſays he), that there are in each

each county of England and Wales 2000 acres upon an average which might be thus treated, and every acre increaſed at leaſt one pound in annual value. The general adoption therefore of watering is capable of being made a national advantage of more than 100,000l. per annum, beſides the great improvement of other land ariſing from the produce of the meadows and the employment of the induſtrious poor. Such an improvement, one would think, is not unworthy of public notice; but if I had doubled the ſum, I believe I ſhould not have exceeded the truth, though I might have gone beyond the bounds of general credibility. In this one pariſh where I reſide there are about 300 acres now watered; and it may be eaſily proved that the proprietors of the land reap from thence 1000l. yearly profit." Culture of Graſs.

In Mr Boſwell's treatiſe upon this ſubject, publiſhed in 1790, the author complains of the neglect of the practice of improving the wet, boggy, and ruſhy lands, which lie at the banks of rivers, and might be meliorated at a very ſmall expence, when much larger ſums are expended in the improvement of barren uplands and large tracts of heath in various parts of the kingdom: and he complains likewiſe of the little information that is to be had in books concerning the method of performing this operation. The only author from whom he acknowledges to have received any information is Blyth; and even his method of watering is very different from that practiſed in modern times; for which reaſon he propoſes to furniſh an original treatiſe upon the ſubject; and of this we ſhall now give the ſubſtance.

The firſt thing to be conſidered is, what lands are capable

Culture of Grafs.

Land capable of being watered.

capable of being watered. Theſe, according to Mr Boſwell, are all ſuch as lie low, near the banks of rivulets and ſprings, eſpecially where the water-courſe is higher than the lands, and kept within its bounds by banks. If the rivulet has a quick deſcent, the improvement by watering will be very great, and the expences moderate. On level lands the water runs but ſlowly, which is alſo the caſe with large rivers; and therefore only a ſmall quantity of ground can be overflowed by them in compariſon of what can be done in other caſes: but the water of large rivers is generally poſſeſſed of more fertilizing properties than that of rivulets. In many caſes, however, the rivers are navigable, or have mills upon them; both of which are ſtrong objections to the perfect improvement of lands adjacent to them. From theſe conſiderations, our author concludes, that the watering of lands may be performed in the beſt and leaſt expenſive manner by ſmall rivulets and ſprings.

There are three kinds of ſoils commonly found near the banks of rivers and rivulets, the melioration of which may be attempted by watering. 1. A gravelly or ſound warm firm ſoil, or a mixture of the two together. This receives an almoſt inſtantaneous improvement; and the faſter the water runs over it the better. 2. Boggy, miry, and ruſhy ſoils, which are always found by the banks of rivers where the land is nearly level. Theſe alſo are greatly improved by watering; perhaps equally ſo with thoſe already deſcribed, if we compare the value of both in their unimproved ſtate, this kind of ground being ſcarce worth any thing in its unimproved ſtate. By proper watering, however, it may be made to produce large crops

of

of hay, by which horned cattle may be kept through the winter and greatly forwarded; though, in its uncultivated ſtate, it would ſcarce produce any thing to maintain ſtock in the winter, and very little even in ſummer. Much more ſkill, as well as expence, however, is requiſite to bring this kind of land into culture than the former. 3. The ſoils moſt difficult to be improved are ſtrong, wet, and clay ſoils; and this difficulty is occaſioned both by their being commonly on a dead level, which will not admit of the water running over them; and by their tenacity, which will not admit of draining. Even when the utmoſt care is taken, unleſs a ſtrong body of water is thrown over them, and that from a river the water of which has a very fertilizing property, little advantage will be gained; but wherever ſuch advantages can be had in the winter, and a warm ſpring ſucceeds, theſe lands will produce very large crops of graſs. Culture of Graſs.

The advantage of uſing ſprings and rivulets for watering inſtead of large rivers is, that the expence of raiſing wares acroſs them will not be great; nor are they liable to the other objections which attend the uſe of large rivers. When they run through a cultivated country alſo, the land floods occaſioned by violent rains frequently bring with them ſuch quantities of manure as contribute greatly to fertilize the lands, and which are totally loſt where the practice of watering is not in uſe. Springs and rivulets preferable to large rivers.

Springs may be uſeful to the coarſe lands that lie near them, provided the water can be had in ſufficient quantity to overflow the lands. "By ſprings (ſays our author), are not here meant ſuch as riſe out of poor heath or boggy lands (for the water iſſuing from them

Culture of Grafs.

them is generally ſo ſmall in quantity, and always ſo very lean and hungry in quality, that little if any advantage can be derived from it; but rather the head of rivulets and brooks riſing out of a chalky and gravelly ſound firm ſoil, in a cultivated country. Theſe are invaluable; and every poſſible advantage ſhould be taken to improve the ground near them. The author knows a conſiderable tract of meadow-land under this predicament; and one meadow in particular that is watered by ſprings iſſuing immediately out of ſuch a ſoil, without any advantage from great towns, &c. being ſituated but a ſmall diſtance below the head of the rivulet, and the rivulet itſelf is fed all the way by ſprings riſing out of its bed as clear as cryſtal. The ſoil of the meadow is a good loam ſome inches deep, upon a fine ſpringy gravel. Whether it is from the heat of the ſprings, or whether the friction by the water running over the ſoil raiſes a certain degree of warmth favourable to vegetation, or from whatever cauſe it ariſes, the fecundity of this water is beyond conception; for when the meadow has been properly watered and well drained, in a warm ſpring, the graſs has been frequently cut for hay within five weeks from the time the ſtock was taken out of it, having eaten it bare to the earth: almoſt every year it is cut in ſix weeks, and the produce from one to three waggon loads to an acre. In land thus ſituated, in the mornings and evenings in the months of April, May, and June, the whole meadow will appear like a large furnace: ſo conſiderable is the ſteam or vapour which ariſes from the warmth of the ſprings acted upon by the ſun-beams: and although the water is ſo exceeding clear, yet upon its being thrown over the land only

ly a few days in warm weather, by dribbling through the graſs, ſo thick a ſcum will ariſe and adhere to the blades of the graſs, as will be equal to a conſiderable quantity of manure ſpread over the land, and (it may be preſumed from the good effects) ſtill more enriching. Culture of Graſs.

"It is inconceivable what 24 hours water properly conveyed over the lands will do in ſuch a ſeaſon: a beautiful verdure will ariſe in a few days where a parched ruſty ſoil could only be ſeen; and one acre will then be found to maintain more ſtock than ten could do before."

Mr Boſwell next proceeds to an explanation of the terms uſed in this art; of the inſtruments neceſſary to perform it; and of the principles on which it is founded. The terms uſed are: Explanation of the terms uſed in watering.

1. A *Ware.* This is an erection acroſs a brook, rivulet, or river, frequently conſtructed of timber, but more commonly of bricks or ſtones and timber, with openings to let the water paſs, from two to ten in number according to the breadth of the ſtream: the height being always equal to the depth of the ſtream compared with the adjacent land. The uſe of this is occaſionally to ſtop the current, and to turn it aſide into the adjacent lands.

2. A *Sluice* is conſtructed in the ſame manner as a ware; only that it has but a ſingle paſſage for the water, and is put acroſs ſmall ſtreams for the ſame purpoſes as a ware.

3. A *Trunk* is deſigned to anſwer the ſame purpoſes as a ſluice; but being placed acroſs ſuch ſtreams as either cattle or teams are to paſs over, or where it is neceſſary to carry a ſmall ſtream at right angles to a large

Culture of Graſs.

large one to water ſome lands lower down, is for theſe reaſons made of timber, and is of a ſquare figure. The length and breadth are various, as circumſtances determine.

4. A *Carriage* is made of timber or of brick. If of timber, oak is the beſt; if of brick, an arch ought to be thrown over the ſtream that runs under it, and the ſides bricked up: But when made of timber, which is the moſt common material, it is conſtructed with a bottom and ſides as wide and high as the main in which it lies. It muſt be made very ſtrong, cloſe, and well jointed. Its uſe is to convey the water in one main over another, which runs at right angles to it; the depth and breadth are the ſame with thoſe of the main to which it belongs: and the length is determined by that which it croſſes. The carriage is the moſt expenſive inſtrument belonging to watering.

5. A *Drain-ſluice*, or *drain-trunk*, is always placed in the lower part of ſome main, as near to the head as a drain can be found; that is, ſituated low enough to drain the main, &c. It is made of timber, of a ſquare figure like a trunk, only much ſmaller. It is placed with its mouth at the bottom of the main, and let down into the bank; and from its other end a drain is cut to communicate with ſome trench-drain that is neareſt. The dimenſions are various, and determined by circumſtances. The uſe of it is, when the water is turned ſome other way, to convey the leaking water that oozes through the hatches, &c. into the drain, that otherwiſe would run down into the tails of thoſe trenches which lie loweſt, and there poach and rot the ground, and probably contribute not a little to making it more unſound for ſheep. This operation is of the utmoſt

conſequence

conſequence in watering; for if the water be not thoroughly drained off the land, the ſoil is rotted; and when the hay comes to be removed, the wheels of the carriages ſink, the horſes are mired, and the whole load ſometimes ſticks faſt for hours together. On the other hand, when the drain trunks are properly placed, the ground becomes firm and dry, and the hay is ſpeedily and eaſily removed. Culture of Graſs.

7. *Hatches* are beſt made of oak, elm, or deal; the uſe of them is to fit the openings of wares, trunks, or ſluices; and to keep back the water, when neceſſary, from paſſing one way, to turn it another. They ought to be made to fit as cloſe as poſſible. When hatches belong to wares that are erected acroſs large ſtreams, or where the ſtreams ſwell quickly with heavy rains, when the hatches are in their places to water the meadows they are ſometimes made ſo, that a foot or more of the upper part can be taken off, ſo that vent may be given to the ſuperfluous water, and yet enough retained for the purpoſe of watering the meadows. In this caſe, they are called *flood-hatches*: but Mr Boſwell entirely diſapproves of this conſtruction, and recommends them to be made entire, though they ſhould be ever ſo heavy, and require the aſſiſtance of a lever to raiſe them up. For when the water is very high, and the hatches are ſuddenly drawn up, the water falls with great force upon the bed of the ware, and in time greatly injures it: but when the whole hatch is drawn up a little way, the water runs off at the bottom, and does no injury.

8. A *head-main*, is a ditch drawn from the river, rivulet, &c. to convey the water out of its uſual current, to water the lands laid out for that purpoſe, by

Culture of Graſs.

means of leſſer mains and trenches. The head-main is made of various dimenſions, according to the quantity of land to be watered, the length or deſcent of it, &c. Smaller mains are frequently taken out of the head one; and the only difference is in point of ſize, the ſecondary mains being much ſmaller than the other. They are generally cut at right angles, or nearly ſo, with the other, though not invariably. The uſe of the mains, whether great or ſmall, is to feed the trenches with water, which branch out into all parts of the meadow, and convey the water to float the land. By ſome, theſe ſmaller mains are improperly called *carriages*.

9. A *trench* is a ſmall ditch made to convey the water out of the mains for the immediate purpoſe of watering the land. It ought always to be drawn in a ſtraight line from angle to angle, with as few turnings as poſſible. It is never deep, but the width is in proportion to the length it runs, and the breadth of the plane between that and the trench-drain. The breadth tapers gradually to the lower end.

10. A *trench-drain* is always cut parallel to the trench, and as deep as the tail-drain water will admit, when neceſſary. It ought always, if poſſible, to be cut down to a ſtratum of ſand, gravel, or clay. If into the latter, a ſpade's depth into it will be of great advantage. The uſe of it is to carry away the water immediately after it has run over the panes from the trench. It need not be drawn up to the head of the land by five, ſix, or more yards, according to the nature of the ſoil. Its form is directly the reverſe of the trench; being narrow at the head, and growing gradually wider and wider until it empties itſelf into the tail-drain.

11.

11. The *tail-drain* is deſigned as a receptacle for all the water that flows out of the other drains, which are ſo ſituated that they cannot empty themſelves into the river. It would run, therefore, nearly at right angles with the trenches, though generally it is thought moſt eligible to draw it in the loweſt part of the ground, and to uſe it to convey the water out of the meadows at the place where there is the greateſt deſcent; which is uſually in one of the fence-ditches; and hence a fence-ditch is uſually made uſe of inſtead of a tail-drain, and anſwers the double purpoſe of fencing a meadow, and draining it at the ſame time. Culture of Graſs.

12. A *pane* of ground is that part of the meadow which lies between the trench and the trench-drain; and in which the graſs grows for hay. It is watered by the trenches, and drained by the trench-drains; whence there is a pane on each ſide of every trench.

13. A *way-pane* is that part of the ground which lies in a properly watered meadow, on the ſide of the main where no trenches are taken out, but is watered the whole length of the main over its banks. A drain for carrying off the water from this pane runs parallel to the main. The uſe is to convey the hay out of the meadows, inſtead of the teams having to croſs all the trenches.

14. A *bend* is made in various parts of thoſe trenches which have a quick deſcent, to obſtruct the water. It is made, by leaving a narrow ſtrip of green ſward acroſs the trench where the bend is intended to be left; cutting occaſionally a piece of the ſhape of a wedge out of the middle of it. The uſe is to check the water, and force it over the trench into the panes; which, were it not for theſe bends, would run rapidly on in the trench,

Culture of Grafs.

and not flow over the land as it paſſes along. The great art of watering conſiſts in giving to each part of the panes an equal proportion of water.

15. A *gutter* is a ſmall groove cut out from the tails of theſe trenches where the panes run longer at one corner than the other. The uſe is to carry the water to the extreme point of the pane. Thoſe panes which are interſected by the trench and tail-drains, meeting in an obtuſe angle, require the aſſiſtance of gutters to convey the water to the longeſt ſide. They are likewiſe uſeful, when the land has not been ſo well levelled, but ſome parts of the panes lie higher than they ought: in which caſe, a gutter is drawn from the trench over that high ground, which otherwiſe would not be overflowed. Without this precaution, unleſs the flats be filled up (which ought always to be done when materials can be had to do it) the water will not riſe upon it; and after the watering ſeaſon is paſt, thoſe places would appear ruſty and brown, while the reſt is covered with beautiful verdure. Our author, however, is of opinion, that this method of treating water meadows ought never to be followed; but that every inequality in water meadows ſhould either be levelled or filled up. Hence the waterman's ſkill is ſhown in bringing the water over thoſe places to which it could not naturally riſe, and in carrying it off from thoſe where it would naturally ſtagnate.

16. A *catch-drain* is ſometimes made uſe of when water is ſcarce. When a meadow is pretty long, and has a quick deſcent, and the water runs quickly down the drains, it is cuſtomary to ſtop one or more of them at a proper place, till the water flowing thither riſes ſo high as to ſtrike back either into the tail-drains ſo as to

ſtagnate

ſtagnate upon the ſides of the panes, or till it flows over the banks of the drains, and waters the grounds below, or upon each ſide. It is then to be conveyed over the land in ſuch quantity as is thought proper, either by a ſmall main, out of which trenches are to be cut with their proper drains, or by trenches taken properly out of it. In caſe of a ſtagnation, the deſign will not ſucceed; and it will then be neceſſary to cut a paſſage to let the ſtagnating water run off. Even when the method ſucceeds beſt, Mr Boſwell is of opinion, that it is not by any means eligible; the water having been ſo lately ſtrained over the ground, that it is ſuppoſed by the watermen not to be endowed with ſuch fertilizing qualities as at firſt; whence nothing but abſolute neceſſity can juſtify the practice. Culture of Graſs.

17. A *pond* is any quantity of water ſtagnating upon the ground, or in the tail-drain, trench-drains, &c. ſo as to annoy the ground near them. It is occaſioned ſometimes by the flats not having been properly filled up; at others, when the ware not being cloſe ſhut, in order to water ſome grounds higher up, the water is thereby thrown back upon the ground adjacent.

18. A *turn* of water ſignifies as much ground as can be watered at once. It is done by ſhutting down the hatches in all thoſe wares where the water is intended to be kept out, and opening thoſe that are to let the water through them. The quantity of land to be watered at once muſt vary according to circumſtances; but Mr Boſwell lays down one general rule in this caſe, viz. that no more land ought to be kept under water at one time than the ſtream can ſupply regularly with a ſufficient quantity of water; and if

Culture of Graſs.

this can be procured, water as much ground as poſſible.

19. The *head* of the meadow is that part of it into which the river, main, &c. firſt enter.

20. The *tail* is that part out of which the river, &c. laſt paſſes.

21. The *upper ſide* of a main or trench, is that ſide which (when the main or trench is drawn at right angles, or nearly ſo, with the river) fronts the part where the river entered. The lower ſide is the oppoſite.

22. The *upper pane* in a meadow, is that which lies on the upper ſide of the main or trench that is drawn at right angles with the river: where the river runs north and ſouth, it enters in the former direction, and runs out in the ſouthern, the main and trenches running eaſt and weſt. Then all thoſe panes which lie on the north ſide of the mains are called *upper* panes; and thoſe on the ſouth ſide the *lower* panes. But when the mains, trenches, &c. run parallel to the river, there is no diſtinction of panes into upper and lower.

The inſtruments uſed in watering meadows are:

1. A *water-level.* The uſe of this is to take the level of the land at a diſtance, and compare it with that of the river, in order to know whether the ground can be overflowed by it or not. This inſtrument, however, is uſed only in large undertakings; for ſuch as are on a ſmaller ſcale, the workmen diſpenſe with it in the following manner: In draining a main, they begin at the head, and work deep enough to have the water follow them. In drawing a tail-drain, they begin at the lower end of it and work upwards, to let the tail

water

water come after them. By this method we obtain the moſt exact level. Culture of Graſs.

2. The *line*, *reel*, and *breaſt-plough*, are abſolutely neceſſary. The line ought to be larger and ſtronger than that uſed by gardeners.

3. *Spades*. Thoſe uſed in watering meadows are made of a particular form, on purpoſe for the work; having a ſtem conſiderably more crooked than thoſe of any other kind. The bit is iron, about a foot wide in the middle, and terminating in a point: a thick ridge runs perpendicularly down the middle, from the ſtem almoſt to the point. The edges on both ſides are drawn very thin, and being frequently ground and whetted, the whole ſoon becomes narrow; after which the ſpades are uſed for trenches and drains; new ones being procured for other purpoſes. The ſtems being made crooked, the workmen ſtanding in the trench or drain are enabled to make the bottoms quite ſmooth and even.

4. *Wheel* and *hand-barrows*. The former are uſed for removing the clods to the flat places, and are quite open, without any ſides or hinder part. The latter are of ſervice where the ground is too ſoft to admit the uſe of wheel-barrows, and when clods are to be removed during the time that the meadow is under water.

5. *Three-wheeled carts* are neceſſary when large quantities of earth are to be removed; particularly when they are to be carried to ſome diſtance.

6. Short and narrow *ſcythes* are made uſe of to mow the weeds and graſs, when the water is running in the trenches, drains, and mains.

7. *Forks* and long *crooks* with four or five tines, are

Culture of Gruſs.

uſed for pulling out the roots of ſedges, ruſhes, reeds, &c. which grow in the large mains and drains. The crooks ſhould be made light, and have long ſtems to reach wherever the water is ſo deep that the workmen cannot work in it.

8. Strong *water-boots*, the tops of which will draw up half the length of the thigh, are indiſpenſably neceſſary. They muſt alſo be large enough to admit a quantity of hay to be ſtuffed down all round the legs, and be kept well tallowed to reſiſt the running water for many hours together.

Principles on which the practice of watering depends.

The principles on which the practice of watering meadows depend are few and eaſy.

1. Water will always riſe to the level of the receptacle out of which it is originally brought.

2. There is in all ſtreams a deſcent greater or ſmaller; the quantity of which is in ſome meaſure ſhown by the running of the ſtream itſelf. If it run ſmooth and ſlow, the deſcent is ſmall; but if rapidly and with noiſe, the deſcent is conſiderable.

3. Hence if a main be taken out of the river high enough up the ſtream, water may be brought from that river to flow over the land by the ſide of the river, to a certain diſtance below the head of the main, although the river from whence it is taken ſhould, oppoſite to that very place, be greatly under it.

4. Water, ſunk under a carriage which conveys another ſtream at right angles over it, one, two, or more feet below its own bed, will, when it has paſſed the carriage, riſe again to the level it had before.

5. Water conveyed upon any land, and there left ſtagnated for any length of time, does it an injury; deſtroying

ſtroying the good herbage, and filling the place with ruſhes, flags, and other weeds. Culture of Graſs.

6. Hence it is abſolutely neceſſary, before the work is undertaken, to be certain that the water can be thoroughly drained off.

In Mr Wright's treatiſe upon this ſubject, the author conſiders a ſolution of the three following queſtions as a neceſſary preliminary to the operation of watering. 1. Whether the ſtream of water will admit of a temporary dam or ware acroſs it? 2. Can the farmer raiſe the water by this means a few inches above its level, without injuring his neighbour's land? 3. Can the water be drawn off from the meadow as quick as it is brought on? If a ſatisfactory anſwer can be given to all theſe queſtions, he directs to proceed in the following manner. Wright's method.

Having taken the level of the ground, and compared it with the river, as directed by Mr Boſwell, cut a deep wide nich as near the dam as poſſible, and by it convey the water directly to the higheſt part of the meadow; keeping the ſides or banks of the ditch of an equal height, and about three inches higher than the general ſurface of the meadow. Where the meadow is large, and has an uneven ſurface, it will ſometimes be neceſſary to have three works in different directions, each five feet wide, if the meadow contains 15 acres, and if the higheſt part be fartheſt from the ſtream. A ditch of 10 feet wide and three deep will commonly water 10 acres of land. When there are three works in a meadow, and flood-hatches at the mouth of each, when the water is not ſufficient to cover the whole completely at once, it may be watered at three different times, by taking out one of the hatches,

Culture of Grafs.

hatches, and keeping the other two in. In this caſe, when the water has run over one diviſion of the land for 10 days, it may then be taken off that and tumbled over to another, by taking up another hatch and letting down the former; by which means the three diviſions will have a proper ſhare of the water alternately, and each reap equal benefit. The bottom of the firſt work ought to be as deep as the bottom of the river, when the fall in the meadow will admit of it; for the deeper the water is drawn, the more mud it carries along with it. From the works cut, at right angles, ſmall ditches or troughs, having a breadth proportioned to the diſtance to which ſome part of the water is to be carried, their diſtance from each other being about 12 yards. A trough two feet wide and one foot deep, will water a ſurface 12 yards wide and 40 feet long. In each trough as well as ditch place frequent ſtops and obſtructions, eſpecially when the water is rapid, to keep it high enough to flow through the notches or over the ſides. Each ditch and trough is gradually contracted in width, as the quantity of water conſtantly decreaſes the farther they proceed. Between every two troughs and at an equal diſtance from both, cut a drain as deep as you pleaſe parallel to them, and wide enough to receive all the water that runs over the adjacent lands, and to carry it off into the maſter-drain with ſuch rapidity as to keep the whole ſheet of water in conſtant motion; and if poſſible, not to ſuffer a drop to ſtagnate upon the whole meadow. "For a ſtagnation, ſays he, (though it is recommended by a Mr D. Young for the improvement of arable land), is what we never admit in our ſyſtem of watering; for we find that it rots the turf,

ſoaks

ſoaks and ſtarves the land, and produces nothing but coarſe graſs and aquatic weeds. Culture of Graſs.

"When a meadow lies cold, flat, and ſwampy, the width of the bed, or the diſtance between the trough and drain, ought to be very ſmall, never exceeding ſix yard; indeed, in this caſe, you can ſcarcely cut your land too much, provided the water be plentiful; for the more you cut, the more water you require. The fall of the bed in every meadow ſhould be half an inch in a foot: leſs will do, but more is deſirable; for when the draught is quick, the herbage is always fine and ſweet. The water ought never to flow more than two inches deep, nor leſs than one inch, except in the warm months."

Mr Wright proceeds next to anſwer ſome objections made by the Reviewers in their account of the firſt edition of his work. 1. That the Glouceſterſhire farmers uſe more water for their lands than is neceſſary. To this it is anſwered, That where water is plentiful, they find it advantageous to uſe even more water than he recommends; and when water is ſcarce, they chooſe rather to water only one half, or even a ſmaller portion of a meadow at a time, and to give that a plentiful covering, than to give a ſcanty one to the whole. 2. The Reviewers likewiſe recommend a repeated uſe of the ſame water upon different and lower parts of the ſame meadow, or to make each drain ſerve as a trough to the bed which is below it. But though this method is, in ſome degree, recommended by the celebrated Mr Bakewell, and taught by a ſyſtematic waterer in Staffordſhire, he entirely diſapproves of it; excepting where the great declivity of the land will not admit of any other plan. "This cannot (ſays he) be

Objections to his method anſwered.

A repeated uſe of the ſame water is not eligible.

Culture of Grafs.

be a proper mode of watering graſs-land in the winter time; for it can be of no ſervice to the loweſt parts of the meadow, unleſs as a wetting in ſpring or ſummer. The firſt or higheſt part of a meadow laid out according to this plan will indeed be much improved; the ſecond may reap ſome benefit; but the third, which receives the exhauſted thin cold water, will produce a very unprofitable crop. Our farmers never chooſe more than a ſecond uſe in the ſame meadow, and that very ſeldom; they call even the ſecond running by the ſignificant name of *ſmall beer*; which, they ſay, may poſſibly ſatisfy thirſt, but can give very little life or ſtrength to land. It is a much better method to have a meadow laid out ſo as to be watered at ſeveral times, and to be at the expence of ſeveral ſmall flood-hatches, than to water the whole of it at once by means of catch-drains.

"Sometimes it is neceſſary, in a large meadow, to convey the water that has been uſed under the works and troughs; and then the water above is ſupported by means of boards and planks, which we call a *carry-bridge*. Sometimes, the better to regulate the courſe of the water on the ſurface, eſpecially in the ſpring, narrow trenches are dug, and the mould laid by the ſide of them, in order to be reſtored to its former place when the watering is finiſhed. The earth and mud thrown out in cleanſing and paring the ditches ſhould be carried to fill up the low hollow parts of the meadow, and be trodden down with an even ſurface; which will eaſily be done when the water is on, the waterman being always provided with a ſtrong pair of water-proof boots. If the mould thus uſed has upon it a turf that is tolerably fine, place it uppermoſt; but

if

if it is ſedgy and coarſe, turn it under, and the water if it runs quick will ſoon produce a fine herbage upon it. Culture of Graſs.

"The grounds that are watered in the eaſieſt and moſt effectual manner, are ſuch as have been ploughed and ridged up in lands about twelve yards wide. Here the water is eaſily carried along the ridge by means of a ſmall ditch or trough cut along its ſummit, and then, by means of the ſtops in it, is made to run down the ſides or beds into the furrows, by which it is carried into the maſter-drain, which empties itſelf into the river. Every meadow, before it is well watered, muſt be brought into a form ſomething like a field that has been thus left by the plough in a ridged ſtate. Each ſide of the ridge ſhould be as nearly as poſſible an exact inclined plane, that the water may flow over it as equally as may be." Mr Wright does not, like Mr Boſwell, diſapprove of the uſe of flood-hatches; he only gives the following hint, viz. that their baſis ſhould be deep and firmly fixed, well ſecured with ſtone and clay, that it be not blown up. The following directions are given for each month of watering.

In the beginning of November, all the ditches, troughs, and drains, are to be thoroughly cleanſed by the ſpade and breaſt-plough, from weeds, graſs, and mud; and well repaired, if they have received any injury from cattle. After a ſhower, when the water is thick and muddy, turn over the meadow as much water as you can without injuring the banks of the works, eſpecially if the land be poor; as in this month, according to our author, the water contains many more fertilizing particles, which he calls *ſalts* and *richneſs*, than later in the winter. In defence of this poſition, Of cleaning and repairing the works. Thick and muddy water to be uſed when it can be done.

of

Culture of Graſs.

of which it ſeems the Monthly Reviewers have doubted, our author urges, that though he is not able to prove it by any chemical analyſis, yet it ſeems evident, that "after the firſt waſhing of farm yards, various ſinks, ditches, and the ſurface of all the adjoining fields, which have lain dry for ſome time, the common ſtream ſhould then contain much more fattneſs than when the ſame premiſes have been repeatedly waſhed." This is confirmed by the experience of the Glouceſterſhire farmers; who, if they can at this ſeaſon of the year procure plenty of muddy water to overflow their grounds for one week, look upon it to be equally valuable with what is procured during all the reſt of the winter. In ſupport of this, he quotes the following words of Mr Forbes, in a treatiſe on watering: "The water ſhould be let in upon the meadow in November, when the firſt great rains make it muddy, for then it is full of a rich ſediment, brought down from the lands of the country through which it runs, and is waſhed into it by the rain; and as the ſediment brought by the firſt floods is the richeſt, the carriages and drains of the meadow ſhould all be ſcoured clean and in order, before theſe floods come."

"In oppoſition (adds Mr Wright) to the opinion of ſpeculative waterers, that the muddineſs of the water is of little conſequence, I heſitate not to affirm, that the mud is of as much conſequence in winter-watering, as dung is in the improvement of a poor upland field. For each meadow in this neighbourhood is fruitful in proportion to the quantity of mud that it collects from the water. And, indeed, what can be conceived more enriching than the abundant particles of putrid matter which float in the water, and are diſtributed over the

the ſurface of the land, and applied home to the roots of the graſs. It is true, that any the moſt ſimple water thrown over a meadow in proper quantity, and not ſuffered to ſtagnate, will ſhelter it in winter, and in the warmth of ſpring will force a crop; but this unuſual force muſt exhauſt the ſtrength of the land, which will require an annual ſupply of manure in ſubſtance, or, in a courſe of years, the ſoil will be impaired rather than improved. The meadows in this county, which lie next below a market town or village, are invariably the beſt; and thoſe which receive the water after it has been two or three times uſed, reap proportionably leſs benefit from it: For every meadow that is well laid out, and has any quantity of graſs upon its ſurface, will act as a fine ſieve upon the water, which, though it flow in ever ſo muddy, will be returned back to the ſtream as clear as it came from the fountain. This circumſtance, when there is a range of meadows to be watered, the property of different perſons, when water is ſcarce, creates vehement contentions and ſtruggles for the firſt uſe of it. The proprietors are therefore compelled to agree among themſelves, either to have the firſt uſe alternately, or for the higher meadows to dam up, and uſe only one half or a leſs portion of the river. Our farmers know the mud to be of ſo much conſequence in watering, that whenever they find it collected at the bottom of the river, or the ditches, they hire men whole days to diſturb and raiſe it with rakes made for the purpoſe, that it may be carried down by the water, and ſpread upon their meadows. One meadow in South Cerney, I think, is an inconteſtable proof of the conſequence of muddy water. It is watered by a branch of the common ſtream that runs for about half

Culture of Graſs.

Inſtance of the good effects of muddy water.

Culture of Grass.

a mile down a public road. This water, by the mud being continually disturbed by carriages and the feet of cattle, becomes very thick, and when it enters the meadow is almost as white as milk. This field, which consists of seven acres, was a few years ago, let for 10s. an acre; but is already become the richest land in the parish, and has produced at one crop eighteen loads of hay, and each load more than 25 hundred weight.

Mr Wimpey's opinion upon the subject.

In further confirmation of what our author asserts, he quotes, from the Annals of Agriculture, the following words of Mr Wimpey: "As to the sorts of water, little is to be found, I believe, which does not encourage and promote vegetation, even the most simple, elementary, and uncompounded fluid: heat and moisture, as well as air, are the *sine qua non* of vegetation as well as animal life. Different plants require different proportions of each to live and flourish; but some of each is absolutely necessary to all. However, experience as well as reason universally shows, that the more turbid, feculent, and replete with putrescent matter the water is, the more rich and fertilizing it proves. Hasty and impetuous rains, of continuance sufficient to produce a flood, not only dissolve the salts, but wash the manure in substance off the circumjacent land into the rapid current. Such turbid water is both meat and drink to the land; and, by the unctuous sediment and mud it deposites, the soil is amazingly improved and enriched. The virtue of water from a spring, if at all superior to pure elementary water, is derived from the several strata or beds of earth it passes through, which, according to the nature of such strata, may be friendly or otherwise to vegetation. If it passes through chalk, marl, fossil shells, or any thing

of

of a calcareous nature, it would in moſt ſoils promote the growth of plants; but if through metallic ores, or earth impregnated with the vitriolic acid, it would render the land unfertile, if not wholly barren. In general, the water that has run far is ſuperior to that which immediately flows from the ſpring, and more eſpecially that which is feculent and muddy, conſiſting chiefly of putrid animal ſubſtances waſhed down the ſtream." Culture of Graſs.

To the ſame purpoſe alſo ſays Mr Forbes: "There is great difference in the quality of waters, ariſing from the particles of different kinds of matter mixed with them. Thoſe rivers that have a long courſe through good land, are full of fine particles, that are highly fertilizing to ſuch meadows as are uſually overflowed by them; and this chiefly in floods, when the water is fulleſt of a rich ſediment: for when the water is clear, though it may be raiſed by art high enough to overflow the adjoining lands, and be of ſome ſervice to them, the improvement thus made is far ſhort of what is obtained from the ſame water when it is thick and muddy. Confirmed by Mr Forbes.

Mr Boſwell, though quoted by Mr Wright as an advocate for the doctrine juſt now laid down, ſeems, in one part of his work at leaſt, to be of a contrary opinion. This is in the 14th chapter of his book, where he remarks upon another publication on the ſame ſubject, the name of which he does not mention: "In page 4. of that pamphlet (ſays Mr Boſwell), the writer informs us, 'if the water uſed be always pure and ſimple, the effect will by no means be equal to the above; that is, of a ſtream that is ſometimes thick and muddy. We have a ſtriking inſtance of this in two of our meadows, which are watered immediately from Mr Boſwell's opinion.

Culture of Graſs.

ſprings that ariſe in the grounds themſelves. Their crops are early and plentiful, but not of a good quality, and the land remains unimproved after many years watering.'

"The writer of this treatiſe (Mr Boſwell), in a former edition, had aſſerted, and in this repeated, the contrary effects from a ſtream very near the ſpring-head, as clear as cryſtal.

"The gentleman (Mr Beverly of Keld) whom that writer mentions in his preface, made a ſhort viſit into Dorſetſhire, to ſatisfy himſelf of the fact. The editor had the pleaſure to ſhow him the ſtream alluded do, which he traced almoſt to the fountain-head. It was perfectly clear, and the water was then immediately conveyed out of the ſtream upon the lands adjoining, ſome of which it was then running over; others it had been upon, and the verdure was then appearing. The gentleman expreſſed himſelf perfectly ſatisfied with the fact. To him the editor wiſhes to refer, &c. Mr George Culley of Fenton near Wooler in Northumberland, with a truly noble and public ſpirit that does him great honour as a friend to his country, ſent a very ſenſible young man from thence into Dorſetſhire, to learn the art of watering meadows, and to work the whole ſeaſon in thoſe meadows under different watermen. This man was often over thoſe meadows, and worked in ſome juſt below that were watered by the ſame ſtream. Might the editor preſume to offer his opinion upon this ſeeming contradiction, it is very probable that the ſoils, both the upper and under ſtrata, are very different, as well as thoſe through which the different ſprings run."

From this paſſage, the latter part of which is not very

very intelligible, we might conclude that Mr Boſwell prefers clear to muddy water for overflowing meadows. In his chapter on land-floods, however, he expreſſes himſelf as follows: "They will (ſays he) always be found of great uſe where the ſweepings of towns, farm-yards, &c. are carried down by them; ſeldom any other erection is wanting beſides a ſluice or ſmall ware to divert and convey them over the lands. If the ſituation of the land happen to be on the ſide of a hill, catch-drains are abſolutely neceſſary for watering the lower part of the hill, after the water has been uſed upon the upper. In many parts of the kingdom, where there are large hills or extenſive riſing lands, great quantities of water run from them into the valleys after heavy rains: Theſe might with proper attention be collected together before they get to the bottom or flat ground, and from thence be diverted to the purpoſe of watering thoſe lands that lie below, with great advantage to the occupier, and at a ſmall expence. And ſhould the land thus ſituated be arable, yet it would be found a beneficial exchange to convert it into paſture; particularly if paſture-ground ſhould be a deſirable object to the occupier. The method of performing it is thus recommended. Obſerve the piece of land or field beſt adapted to the purpoſe, both for ſituation and ſoil. If it ſhould be arable, make it firſt very level; and with the crop of corn ſow all ſorts of hay ſeeds; and as ſoon as it has got a green ſward it may be laid out. In the loweſt part of the ground draw a deep ditch for the current to run in through it; and continue it into ſome ditch or low part in the lands below, that the water may be freely carried off, after it has been and while it is in uſe. Draw ditches above the field intended to be

Culture of Graſs.

Advantages of land-floods.

Of converting arable land into paſture.

Culture of Graſs.

watered, aſlant the ſides of the hill, in ſuch a manner that they may all empty themſelves into the head of the ditch above mentioned, juſt where it enters the field to be watered; then erecting a ware acroſs this ditch, the field will be capable of being watered, according to the ſituation of the ditch in the middle or on the ſide of the field. It muſt then be conveyed by ſmall mains or trenches, and ſubdivided again by branch-trenches, according to the ſite of the field and quantity of water that can be collected; trench-drains muſt be drawn, and the water conveyed into the ditch by means of tail-drains. A perſon unacquainted with water-meadows cannot conceive the advantage ariſing from water thus collected and conveyed over this ſpecies of water-meadow (if it may be ſo called), being generally a firm good ſoil; but the water running down from rich cultivated hills, eminences, &c. ſweeps away with it, when the rain falls very heavy, vaſt quantities of dung dropped by ſheep and other cattle, and the manure carried upon arable lands; all which being now diverted, and carried over the meadow with an eaſy deſcent, gives time for the particles of manure to ſubſide upon the ground at one ſeaſon, or of being filtered from it as it dribbles through the graſs at another; after which the warm weather puſhes on vegetation amazingly. Meadows thus ſituated would be vaſtly ſuperior to any other, if they had the advantage of a conſtant ſtream; but even as they are, taking the opportunity of watering them by every heavy rain or flood that happens, they will be found to be very valuable. The occupier of ſuch lands is ſtrenuouſly adviſed to let no time be loſt in appropriating them to this uſe; becauſe theſe lands are healthy for all kinds

of

of cattle at almoſt all ſeaſons; and the expence of converting them into this kind of water-meadow is exceeding ſmall, the annual charges afterwards quite trifling, and the produce very conſiderable."

Culture of Graſs.

Mr Wright, having diſcuſſed the ſubject of the quality of the water, proceeds to give directions for watering through the different months of the year;—"In December and January, the chief care conſiſts in keeping the land ſheltered by the water from the ſeverity of froſty nights. It is neceſſary, however, through the whole winter, every ten days or fortnight, to give the land air, by taking the water off entirely, otherwiſe it would rot and deſtroy the roots of the graſs. It is neceſſary, likewiſe, that a proper perſon ſhould go over every meadow at leaſt twice every week, to ſee that the water is equally diſtributed, and to remove all obſtructions ariſing from the continual influx of weeds, leaves, ſticks, and the like. In February, a great deal depends upon care and caution. If you now ſuffer the water to remain on the meadow for many days without intermiſſion, a white ſcum is raiſed, very deſtructive to the graſs; and if you take off the water, and expoſe the land to a ſevere froſty night, without its being previouſly dried for a whole day, the greateſt part of the tender graſs will be cut off. The only ways to avoid both theſe injuries are, either to take the water off by day to prevent the ſcum, and to turn it over again at night to guard againſt the froſt; or, if this practice be too troubleſome, both may be prevented by taking the water entirely off for a few days and nights, provided the firſt day of taking off be a dry one; for if the graſs experience one fine drying day, the froſt at night can do little or no injury. The ſcum

Mr Wright's directions for watering thro' the different months of the year.

Culture of Graſs.

is generated chiefly by the warmth of the ſun, when the water is thin and uſed too plentifully. Towards the middle of this month we vary our practice in watering, by uſing only about half the quantity of water which is made uſe of earlier in the winter; all that is now required being to keep the ground in a warm moiſt ſtate, and to force vegetation.

"At the beginning of March, the crop of graſs in the meadows is generally ſufficient to afford an abundant paſturage for all kinds of ſtock, and the water is taken off for near a week, that the land may become dry and firm before the heavy cattle are turned in.—It is proper, the firſt week of eating off the ſpring-feed, if the ſeaſon be cold, to give the cattle a little hay each night."

Of eating off the ſpring-graſs with ewes and lambs.

"It is a cuſtom (ſays Mr Wright) with ſome farmers in Hampſhire to eat off the ſpring graſs of their meadows with ewes and lambs, in the ſame manner that we do a field of turnips, by encloſing a certain portion each day with hurdles or ſtakes, and giving them hay at the ſame time. This is certainly making the moſt of the graſs, and an excellent method to fine and ſweeten the future herbage. In this month and April, you may eat the graſs as ſhort and cloſe as you pleaſe, but never later; for if you treſpaſs only one week on the month of May, the hay-crop will be very much impaired, the graſs will become ſoft and woolly, and have more the appearance and quality of an after-math than a crop. At the beginning of May, or when the ſpring feeding is finiſhed, the water is again uſed for a few days by way of wetting.

"It is rather remarkable, that watering in autumn, winter, or ſpring, will not produce that kind of her-

bage which is the cauſe of the rot in ſheep; but has been known to remove the cauſe from meadows, which before had that baneful effect. If, however, you uſe the water only a few days in any of the ſummer months, all the lands thus watered will be rendered unſafe for the paſturage of ſheep. Of this I was lately convinced from an experiment made by a friend. At the beginning of July, when the hay was carried off, and the water rendered extremely muddy and abundant by ſeveral days rain, he thought proper to throw it over his meadows for ten days, in which time a large collection of extremely rich manure was made upon the land. In about a month the meadow was covered with uncommon luxuriancy and blackneſs of herbage. Into this graſs were turned eight ſound ewes and two lambs. In ſix weeks time the lambs were killed, and diſcovered ſtrong ſymptoms of rottenneſs; and in about a month afterwards one of the ewes was killed, and though it proved very fat, the liver was putrid and replete with the inſect called the *fluke* or *weevil*: the other ewes were ſold to a butcher, and all proved unſound. This experiment, however, convinces me, by the very extraordinary improvement made thereby in the meadow, that muddy water in the ſummer is much more enriching than it is in autumn or winter; and ought, therefore, to be uſed for a week at leaſt every wet ſummer, notwithſtanding its inconveniences to ſheep, the moſt profitable ſpecies of ſtock."

Culture of Graſs.

How watering may occaſion the rot in ſheep.

Mr Boſwell, beſides his general directions for watering, gives many plans of the ditches, drains, &c. for particular meadows, ſome of them done from an actual ſurvey. But theſe being confined to particu-

Culture of Grafs.

lar ſituations, we ſhall here only ſpeak of his method in general. In his third chapter, entitled *A general Deſcription of Water-meadows*, he obſerves, that "lands capable of being watered, lie ſometimes only on one ſide, and ſometimes on both ſides of the ſtream deſigned to ſupply them with water. In the former caſe, when they have a pretty quick deſcent, the land may be often watered by a main drain out of the ſtream itſelf, without any ware;" though he acknowledges that it is by far the beſt way to erect a ware, and to draw mains on each ſide, to diſpoſe of the water to the beſt advantage.

Mr Hoſwell's general directions for watering.

Boggy lands require more and longer continued watering than ſuch as are ſandy or gravelly; and the larger the body of water that can be brought upon them the better. The weight and ſtrength of the water will greatly aſſiſt in compreſſing the ſoil, and deſtroying the roots of the weeds that grow upon it; nor can the water be kept too long upon it, particularly in the winter ſeaſon; and the cloſer it is fed, the better.

To improve ſtrong clay ſoils, we muſt endeavour to the utmoſt to procure the greateſt poſſible deſcent from the trench to the trench-drain; which is beſt done by making the trench-drains as deep as poſſible, and applying the materials drawn out of them to raiſe the trenches. Then, with a ſtrong body of water, taking the advantage of the autumnal floods, and keeping the water ſome time upon them at that ſeaſon, and as often as convenient during the winter, the greateſt improvement on this ſort of ſoils may be made. Warm ſand or gravelly ſoil, are the moſt profitable under the watering ſyſtem, provided the water can be brought over them at pleaſure. In ſoils of this kind, the water muſt not be kept long at a time, but often ſhifted, thorough-

ly

ly drained, and the land frequently refreſhed with it: under which circumſtances the profit is immenſe. A ſpring-feeding, a crop of hay, and two after-maths, may be obtained in a year; and this, probably, where in a dry ſummer ſcarce graſs enough could be found to keep a ſheep alive. If the ſtream be large, almoſt any quantity of land may be watered from it; and though the expence of a ware over it is great, it will ſoon be repaid by the additional crop. If the ſtream is ſmall, the expence will be ſo in proportion. Culture of Graſs.

The following method of improving a water-meadow that was ſpringy has been tried by Mr Boſwell with ſucceſs. The meadow had been many years watered by a ſpring riſing juſt above it from a barren ſandy heath; the ſoil near the ſurface was in ſome places a gravelly ſand, in others a ſpongy cork, both upon a ſtrong clay and ſand mixture, which retained the draining of the lands above it. Whenever it had been watered, and left to drain itſelf dry, a yelloviſh red water ſtood in many parts, and oozed out of others; the herbage being no other than a poor, miſerable hairy graſs and ſmall ſedge. Chalk and aſhes had been thrown over it to very little purpoſe. It was then drained underground aſlant all the different deſcents, and all theſe drains carried into one large drain, which had been already cut for the purpoſe of carrying off the water when the meadow was overflowed. Theſe drains were cut quite through the mixture of clay and ſand, and as much deeper as the fall of the ground below would admit of; then, with chalk cut for the purpoſe, ſmall hollow drains were formed at the bottom of theſe; the drains were then filled up with the materials that came out. Method of improving a ſpringy water-meadow.

This

Culture of Graſs.

This was done in the beginning of ſummer, and the work frequently examined through the ſeaſon; the ſoil was found firmer than before, and none of that naſty red water to be met with upon the ſurface, though it continually oozed into the drains. In autumn the meadow was again prepared for waterings, by repairing thoſe trenches and drains that were properly ſituated; and by cutting others where wanted, for the purpoſe of watering the meadow. The water being then brought over it from the ſame ſpring as before, the event anſwered the moſt ſanguine wiſhes of the proprietor; the effects were viſible the firſt year, and the ground has been conſtantly improving ever ſince.

Of watering lands on the ſides of hills.

Mr Boſwell alſo informs us, that a gentleman in Scotland had applied to him for directions to water ſome lands lying on the ſides of hills, where the deſcent is quick; and of which there are many in this country, as well as in the north of England. It would be difficult, he thinks, to water ſuch lands by means of drains and trenches according to the directions already given; becauſe the bends in the trenches muſt be very near together and large, as the water muſt flow out of the trench above the bend to flow over the pane below it; the number and ſize would likewiſe be inconvenient, and greatly offend the eye.

Lands of this ſort are generally capable of being ploughed; in which caſe our author directs them to be once ploughed in the ſpring, and ſown with oats or any other kind of grain that will rot the ſward. When the grain is harveſted, plough the land acroſs; the laſt ploughing with the Kentiſh plough, which has a moveable mouldboard, and is called a *turn-wriſt* plough. This turns the furrows down the ſide of the hill,

hill, the horſes going forwards and backwards in the ſame furrows. By this means the land is laid flat without any open furrows in it. Dreſs it down in the ſpring very fine, and ſow it with oats, and mix with ſome kinds of graſs ſeeds very thick. Thus the ground will have but few irregularities; and as ſoon as the corn is carried off, or the following ſpring at fartheſt, the mains and drains may be cut out. Culture of Graſs.

For watering coarſe lands that are firm enough to bear the plough, and ſituated near a ſtream, our author gives the following directions.

"Let the land thus ſituated be ploughed once in the ſpring, and ſown with any grain that will rot ſward. As ſoon as the crop is off, plough it again, and leave it rough through the winter. Work it down early in the ſpring, and plough it in the direction the trenches are to lie, making the ridges of a proper ſize for watering, ten or twelve yards wide for inſtance; work it fine; then gather the ridges up again in the ſame manner, making the laſt furrows of each ridge as deep as poſſible. If the land be not fine, dreſs it down again, and gather it up a ſecond time if neceſſary; and with a ſhovel throw the earth from the edges of the furrows to the tops of the ridges, to give the greateſt poſſible deſcent from the trench to the drain. Sow it with oats and graſs ſeeds very thick; and after the corn is carried off, the trenches may be formed upon the top of each ridge, diſperſing the furrows with a ſpade as much as the fall of the land will admit of for the drains; taking care to procure ſufficient fall at all events, to drain the lands after they have been watered. By this method the crop of corn Of watering coarſe lands.

will

Culture of Grafs.

will nearly pay all the expence, and the land will be in excellent order."

Of the management of meadows after watering.

After the work of watering a meadow is totally finiſhed, and the hay carried off, cattle may be let in to eat the after-math. When this is done, it will then be neceſſary to examine whether or not the mains have ſuffered any injury from their feet; whether there be quantities of mud or ſand collected at the angles, &c. all of which muſt be thrown out and the breaches repaired; by which means the trenches, drains, &c. will laſt three years, but otherwiſe not more than two. The roots, mud, &c. may be uſed in repairing the breaches, but never left upon the ſides of the trenches out of which they are taken. The tail-drains require to be cleanſed oftener than any of the other works, for this obvious reaſon, that the mud, &c. is carried down from all the others into them; where, if it be allowed to accumulate, it occaſions a ſtagnation of water upon the meadow itſelf. In repairing the trenches, particular care ought to be taken that the workmen do not make them any wider than before, which they are very apt to do; neither are they to be allowed to throw the materials which they dig out in a ridge behind the edge of the trench, which both widens it, and promotes weeds.

Of the time the water ſhould continue upon the meadows.

During the time of watering, it will be neceſſary to examine the meadow every two or three days, in order to remove obſtructions, &c. If the drains ſhould be filled with water and run over, they ought to be made deeper; or if this cannot be done, they ſhould be widened. In the winter time a regular ſtrong water ſhould be kept, avoiding very ſtrong great floods. In this ſeaſon the water may be kept on the ground with

ſafety

ſafety for a month, or even ſix weeks, if the ſoil be corky or boggy, or a ſtrong clay; but not quite ſo long if it be gravel or ſand. At the ſecond watering a fortnight or three weeks will be ſufficient; and after Candlemas a fortnight will be rather too long. At the third watering a week will be ſufficient, which will bring it to about the middle of March; by which time, if the weather be tolerably mild, the graſs will be long enough for the ewes and lambs, or fatting lambs; which may then be turned into the meadow with great advantage. Even in the end of February, if the winter has been very mild, the graſs will be long enough for them. Here they may be permitted to feed till the beginning of May, changing them into different meadows. As ſoon as they are taken out, the water muſt be turned in for a week, carefully examining every trench and drain for the reaſons already given. The water is then to be ſhifted into others, alternately watering and draining, leſſening the time the water remains upon it as the weather grows warmer; and in five, ſix, or ſeven weeks, the graſs will be fit to be mown for hay, and produce from one to two tons, or even more, an acre, upon good ground. Culture of Graſs.

Mr Boſwell directs, that about a week before the graſs is to be mown, the water ſhould be let into the meadow for 24 hours; which he ſays, will make the ground moiſt at the bottom, the ſcythe will go through it the more eaſily, and the graſs will be mown cloſer to the ground. This practice, however, is entirely diſapproved of by Mr Wright. "Though it may prevail in Dorſetſhire (ſays he), it is very ſeldom adviſable, for the following reaſons: Water made to run through a thick crop of graſs, though it may appear

Culture of Graſs.

pear ever ſo pure, will leave a certain quantity of adherent ſcum or ſediment, which can never be ſeparated from the hay, but will render it unpalatable, if not prejudicial, to the cattle that eat it. And this wetting of the land and graſs will impede the drying or making of the hay perhaps ſome days, which in difficult ſeaſons is of very great conſequence, and it will likewiſe make the turf too ſoft and tender to ſupport the wheels of a loaded waggon in carrying off the hay. Beſides, there is reaſon to believe that one day's wetting in the ſummer, will, upon moſt meadows, endanger the ſoundneſs of every ſheep that feeds upon the aftermaths."

Of ſpring-feeding.

The ſpring-feeding ought never to be done by heavier cattle than ſheep or calves; for large cattle do much hurt by poaching the ground with their feet, deſtroying the trenches, and ſpoiling the graſs. Mr Boſwell likewiſe greatly recommends a proper uſe of ſpring floods, from which he ſays much benefit may be derived; but, if there is any quantity of graſs in the meadows not eaten, theſe floods muſt be kept out, otherwiſe the graſs will be ſpoiled; for they bring with them ſuch quantities of ſand and mud, which ſtick to the graſs, that the cattle will rather ſtarve than taſte it. Great quantities of graſs or after-math are frequently ſpoiled in flat countries by the floods which take place in the fall. In the winter time, however, when the ground is bare, the ſand and mud brought down by the floods is ſoon incorporated with the ſoil, and becomes an excellent manure. The certain rule with regard to this matter is, "Make uſe of the floods when the graſs cannot be uſed; avoid them when the graſs is long or ſoon to be cut."

"It

Culture of Grafs.

Of watering from the end of autumn to Candlemas.

"It has often been a ſubject of diſpute (ſays Mr Boſwell), whether, from the latter end of autumn to Candlemas, the throwing a very ſtrong body of water, where it can be done, over the meadows, is of any eſſential ſervice or not? Thoſe who conſider it as advantageous, aſſert, that when the waters run rude and ſtrong over the ground, they beat down and rot the turfs of foggy or rough graſs, ſedges, &c. that are always to be found in many parts of coarſe meadow-ground; and therefore are of particular ſervice to them. On the other ſide it is alleged, that by coming in ſo large a body, it beats the ground (in the weak places particularly) ſo bare, that the ſward is deſtroyed; and alſo brings with it ſuch quantities of ſeeds of weeds, that at the next hay ſeaſon the land in all thoſe bare places bears a large burden of weeds, but little graſs.

"The general opinion of the watermen upon this point is, that in water-meadows which are upon a warm, ſandy, or gravelly ſoil, with no great depth of loam upon them, rude ſtrong watering, even in winter, always does harm, without any poſſible eſſential ſervice. On the contrary, cold ſtrong clay land will bear a great deal of water a long time without injury; and boggy, corky, or ſpongy ſoil, will alſo admit of a very large and ſtrong body of water upon it with great advantage for almoſt any length of time at that ſeaſon, provided the drains are made wide and deep enough to carry it off, without forcing back upon the end of the panes. The weight and force of the water vaſtly aſſiſts in compreſſing thoſe ſoils, which only want ſolidity and tenacity to make them produce great burdens of hay: nothing, in their opinion, corrects and improves thoſe ſoils ſo much

Culture of Grafs.

much as a very ſtrong body of water, kept a conſiderable time upon them at that ſeaſon."

Notwithſtanding the above reaſons, however, Mr Boſwell informs us, that he has doubts upon the ſubject; nor can he by any means acquieſce in this opinion, unleſs, by rude ſtrong waters he is permitted to underſtand only rather a larger quantity of water conveyed over the land at this early ſeaſon than ought to be uſed in the ſpring or ſummer: unmanageable waters he believes always hurtful.

"It may be proper juſt to add (continues he), that as ſoon as the hay is carried off the meadows, cattle of any ſort, except ſheep, may be put to eat the graſs out of the trenches, and what may be left by the mowers. This perhaps will laſt them a week; when the water may be put into the meadows in the manner already deſcribed, taking care to mow the long graſs which obſtructs the water in the trenches; and this mowing is beſt done when the water is in them. Let the weeds, leaves, &c. be taken out and put in heaps, to be carried away into the farm yards; examine the trenches, make up the breaches, &c. take particular care that the water only dribbles over every part of the panes as thin as poſſible, this being the warmeſt ſeaſon of the year. The firſt watering ſhould not be ſuffered to laſt longer than two or three days before it is ſhifted off (and, if the ſeaſon be wet, perhaps not ſo long, as warmth ſeems to be the greateſt requiſite after the land is once wet to aſſiſt vegetation) to another part or meadow beat out by the cattle, by this time fit to take it. Do by this meadow exactly the ſame, and ſo by a third and fourth, if as many meadows belong to the occupier. Obſerve at all times, when the water is taken out of a meadow,

meadow, to draw up the drain-ſluice hatches; as, without doing that, watering is an injury. By the time that three or four parts are thus regularly watered, the firſt will have an after-math, with ſuch rich and beautiful verdure as will be aſtoniſhing; and both quantity and quality will be beyond conception better than if the lands had not been watered. Culture of Graſs.

"Hence we ſee why every perſon ſhould, if poſſible, have three or four meadows that can be watered; for here, while the cattle are eating the firſt, the ſecond is growing, the third draining, &c. and the fourth under water. In this manner the after-math will in a mild ſeaſon laſt till Chriſtmas. A reaſon was given why the ſpring-graſs ſhould be fed only by ſheep or calves; a reaſon equally cogent may be given, why the after-graſs ought not to be fed by them, becauſe it will infallibly rot them. No ſheep (ſays our author), except thoſe which are juſt fat, muſt ever be ſuffered even for an hour in water meadows, except in the ſpring of the year; and even then care muſt be taken that every part of the meadows have been well watered, and that they are not longer kept in them than the beginning of May. Although at preſent it is unknown what is the occaſion of the rot, yet certain it is, that even half an hour's feeding in unhealthy ground has often proved fatal. After a ſhort time they begin to loſe their fleſh, grow weaker and weaker; the beſt feeding in the kingdom cannot improve them after they once fall away; and when they die, animalcula, like plaice, are found in the livers. Scarcely any ever recover from a ſlight attack; but when farther advanced, it is always fatal. Guard by all means againſt keeping the water too long upon the meadow in warm weather; it will very ſoon produce a Water ought not to be kept too long upon meadows.

Culture of Grafs.

white ſubſtance like cream, which is prejudicial to the graſs, and ſhows that it has been too long upon the ground already. If it be permitted to remain a little longer, a thick ſcum will ſettle upon the graſs, of the conſiſtence of glue, and as tough as leather, which will quite deſtroy it wherever it is ſuffered to be produced. The ſame bad effects ſeem to ariſe from rude waters; neither can the ſcum eaſily be got off.

Advantages of rolling meadows.

"Rolling meadows in the ſpring of the year is an excellent method. It ſhould be done after Candlemas, when the meadow has been laid dry a week. It ſhould be always rolled lengthwiſe of the panes, up one ſide of the trench and down the other. Rolling alſo contributes much to the graſs being cut cloſe to the ſurface when mown, which is no ſmall advantage; for the little hillocks, ſpewings of worms, ant-hills, &c. are by this means preſſed cloſe to the ground, which would otherwiſe obſtruct the ſcythe and take off its edge; and to avoid that inconvenience, the workmen always mow over them."

As a water-meadow has with ſo much juſtice been called a *hot-bed of graſs*, and as the practice of flooding tends ſo completely to ameliorate the pooreſt ſoils, and to extirpate heath and all coarſe and woody plants, we are ſatisfied that the knowledge of it canno tbe too extenſively diffuſed, or too minutely inquired into. That it may be more clearly underſtood, therefore, we ſhall here give a ſtatement of the mode in which it is practiſed in Glouceſterſhire, as explained from Mr Wright's pamphlet, by the Rev. Mr Charles Findlater, in a letter to the conductors of the Farmer's Magazine.

Watering explained by Mr Findlater.

Plate XIV. "Fig. 1. repreſents a float-meadow under irrigation; the dark ſhading repreſenting the water.

"When

Culture of Graſs.

« When the hatch of the water dam-dike (marked H) is lifted up, the water runs in the natural channel of the river; when the hatch is ſhut, as repreſented in the figures, the natural channel is laid dry below it, and the water runs laterally along the main-feeder, in the direction of the arrows, and is from it diſtributed into the floating gutters *(g, g, g, g)*, which are formed along the crowns of the ridges, into which the meadow is arranged, overflowing on both ſides of ſaid gutter, and running down the ſides of the ridges into the furrows or drains betwixt the ridges *(d, d, d, d)*, which drains diſcharge it into the main-drain, whereby it is returned into its natural channel at the foot of the meadow.

« The marks (oo, or Δ Δ), and the tufts, in the main-feeder and the floating-gutters, denote—The firſt, obſtructions (made by ſmall ſtakes, or ſods, or ſtones) to raiſe the water, and make it flow over from the main-feeder into the floating-gutters, or from the latter over the ſides of the ridges; the ſecond, nicks, made in their ſides, with a ſimilar intention. If, however, the main-feeder and floating-gutters are properly conſtructed at their firſt formation, theſe ſupplementary aids will be, in a great meaſure, unneceſſary: For the main-feeder ought, at its entrance, to be of dimenſions juſt ſufficient to admit the quantity of water which is to be conveyed to the meadow; and gradually to contract its ſize as it goes along, in order that the water, for want of room, may be forced over its ſide, and into the floating-gutters: theſe laſt ought to be formed after the ſame model, that the water may, by their primary conſtruction, overflow their ſides, through their whole courſe. That as little as poſſible of the ſurface may be unproductive, a ſimilar conſtruction ſhould be adopted

Culture of Graſs.

for the drains; they ought to be narrow neareſt to the main-feeder, where they receive little water, and to diverge as they approach the main-drain; which laſt is, for the ſame reaſon, ſimilarly conſtructed. In the plan, this mode of conſtruction is made obvious to the eye.

" The meadow, in this plate, muſt be conceived to lie in a regular and very gentle ſlope from the main-feeder to the main-drain.

" Fig. 2. and fig. 3. preſent a view of the ridges cut acroſs, with the feeding-gutter *(g)* upon their crown, and the furrows, or diſcharging drains *(d, d)* along their ſides. Fig. 3. ſhows the ſhape (or gradual ſlope) into which they ought to be formed at firſt, were it not for the expence, i. e. when they are to be formed out of graſs fields, preſerving the graſs ſward. Fig. 2. repreſents the mode in which they may, more cheaply, though more roughly, be formed at firſt; when, the depoſitions of ſediment from the floating water will gradually fill the ſhoulders of the floating-gutters, up to the dotted line, forming the ridge into the ſhape of fig. 3.

" In the formation of the meadow, (particularly if the declivity is very ſmall), care ſhould be taken to loſe as little as poſſible of the level in the main-feeder, and in the floating-gutters; in order that the greater deſcent may be given to the water down the ſides of the ridges, from the floating-gutters, to their diſcharging drains, that the water may float over the ridges ſides with the more rapidity, and in the more quick ſucceſſion.

" The diſtance from the floating-gutter to the diſcharging-

charging-drain, ought not to be leſs than four yards, i. e. the breadth of the ridge eight yards; nor more than five yards and a half, i. e. the breadth of the ridge eleven yards. Culture of Graſs.

" It it evident from the plan, that, when the hatch (H) is lifted up, the water reſumes its natural channel, and the meadow becomes at once dry. Its figure frees it inſtantly of all ſurface water. If any of it is wet from ſprings, theſe muſt be carried off by under-draining; for it muſt be thoroughly drained before you can drown it to good effect.

" This figure repreſents a float-meadow, where the declivity is unequal, and which, alſo, is too large for the command of water, to admit of being floated all at once. Fig. 4.

" In this meadow, it is ſuppoſed that the ground riſes, from the natural channel of the river, up to (F 1.), which is a feeder, with its floating-gutters *(g, g, g, g)*; and thence deſcends to the hollow (D 1.), which is a drain communicating with the main-drain, and receiving the water from the leſſer drains or receiving furrows (*d, d, d*). It is ſuppoſed, that the ground riſes again from the hollow (D 1.), up to the ſecond feeder (F 2.); and thence deſcends again into the hollow, along which is conducted the receiving-drain (D 2.). The remainder of the meadow is ſuppoſed to lie in a regular ſlope, from the main-feeder to the drain laſt mentioned, and the main-drain. The letter (*r*) marks a very ſmall rut, made with a ſpade, or triangular hoe, for conducting water to places upon which it appears not to ſcatter regularly.

" The hatch upon the river's natural channel, and that upon the feeder (F 2.) are repreſented as ſhut; and,

Culture of Grafs.

conſequently the natural channel, together with that part of the meadow which is floated from the feeder (F 2.), as dry. The hatches upon the feeder (F 1.), and upon the main-feeder, are repreſented as drawn up; and, conſequently the two parts of the meadow, floated from them, are repreſented as under water.

Fig. 5.

" This repreſents catch-meadow, for a ſteep declivity, or ſide of a hill. It is called *catch*, becauſe, when the whole is watered at once, the water floating over the uppermoſt pitches is catched in the floating-gutters, which diſtribute the water over the inferior pitches.

" The lateral horizontal feeding-gutters, which ſcatter the water over the firſt and ſecond pitches, are repreſented as ſhut by ſods or ſtones, &c. (8); and conſequently theſe firſt and ſecond pitches appear dry: The whole water is repreſented as paſſing down the main-feeder into the loweſt floating-gutter, whence it floats the loweſt or third pitch; and is received into the drain at the foot of the meadow, to be returned by it into the natural channel.

" When the whole is to be floated at once, the obſtructions (8) are taken from the lateral floating-gutters: obſtructions, mean time, are placed in the main-feeder, immediately under the floating-gutters, to force the water into ſaid gutters.

" N. B. In obſtructing the main-feeder, care muſt be taken not to obſtruct it entirely, but to allow always a part of the water it contains to eſcape in it to the lower pitches; for, ſuppoſing the main-feeder to be entirely ſhut under the feeding-gutter (*g* 1.); ſo that the whole water was made to run over the firſt pitch, from ſaid gutter and the horizontal part of the main-drain, the water filtrated

filtrated through the graſs of the firſt pitch, would be ſo very much deprived of its fertilizing qualities, as to be incapable of communicating almoſt any perceptible benefit to the pitches lying below. Water ſo filtrated, is called technically *uſed water*; and is eſteemed next to uſeleſs; and for this reaſon, the graſs neareſt the floating-gutters is moſt abundant, and of beſt quality, in all kinds of meadow. Culture of Graſs.

"The proper breadth of the pitches of catch-meadow, from gutter to gutter, does not ſeem well determined; they ought, probably, not to be much broader than the diſtance from the floating-gutter to the receiving-drain in float-meadow, i. e. from four to five or ſix yards.—Catch-meadow is not ſo much prized as float-meadow.

"In the conſtruction of the float-meadows, the floating gutters die away to nothing before they meet the main-drain; the water from the end of the gutter finding its way over the intervening ſpace, or being aſſiſted in ſcattering by ſmall ruts marked (*r*). The receiving-drains ſhould, for like reaſon, not be commenced till within half a ridge breadth of the main-feeder."

It is to be obſerved, with regard to the laſt of theſe modes of flooding, called *catch-meadow*, that although lands thus watered do not become equal to more level grounds ſubjected to the ſame proceſs, or float-meadow, yet that the improvement of them is perhaps greater in proportion to the value of lands in their original ſtate; for in this way, lands on the declivity of hills, which once produced next to nothing, are enabled to bear a conſiderable crop of valuable graſs. As ſtreams of water are in high countries fre- Importance of catch-meadow.

Culture of Grafs.

quently found deſcending from very lofty ſituations, and as in theſe caſes the expence of forming *catch-meadow* is very trifling, it may be regarded as of the moſt extenſive utility.

In conveying water for the purpoſes of irrigation from a river to lands at a diſtance, by means of a canal or open ditch, it is ſometimes neceſſary to croſs a road that is ſituated upon the ſame level. The mode of accompliſhing this object in Lombardy is thus explained by Arthur Young Eſq.*: "The contrivances towards Turin for carrying the aqueducts of irrigation acroſs the roads are beautifully executed; for convenience of diſtribution the water-courſe is raiſed three or four feet or more above the general level: theſe aqueducts are brought to the ſide of the road, and ſeemingly finiſh in a wall, but really ſink in a ſyphon of maſonry under the road, and riſe on the other ſide behind another ſimilar wall. Seeing theſe buttreſſes of maſonry without perceiving at firſt any water, I wondered for a moment, to what uſe they could be aſſigned; but when I mounted the foot-way, this beautiful contrivance was at once apparent."

Water, how conveyed acroſs roads.

Encouragement due to irrigation.

When we conſider the great extent to which irrigation might be carried in many parts of this country, together with the fertility, that is to ſay, the riches, to be derived from the proper uſe of ſo cheap an ingredient as cold water, which is at preſent allowed to run to waſte in ſuch abundance, it is worthy of conſideration how far the legiſlature would not be juſtified in adopting ſome public regulation for giving facility to undertakings

* *Travels*, vol. ii.

undertakings of this ſort. The laſt-quoted author, in travelling through Lombardy, remarks, that "the power of effecting the great works in irrigation, which are viſible over this whole country, depends very much on the law, which ſuppoſes the right and property of all rivers to be veſted in the king; conſequently all canals taken from them are bought of him: and this inſures another regulation, which is the power of carrying the water, when bought, at the pleaſure of thoſe who buy it, where they think fit. They cannot, however, cut acroſs any man's ground, without paying him for the land and for the damage; but the law does this by regulations known to every one, and no individual is allowed a negative upon a meaſure which is for the general good. The purchaſers of water from the king are uſually conſiderable land-owners, or communities that have lands wanting water; and it is of no conſequence at what diſtance theſe lands may be from the river whence the water is taken, as they have a right to conduct it where they chooſe, provided they do not cut through a garden or pleaſure-ground. Nor can they carry the water under that of others, whoſe canals are already made, as they might, in that caſe, deprive them of a part of their water; they are obliged to throw aqueducts over ſuch canals. The benefit of water is ſo great and well underſtood, that nobody ever thinks of making objections; and, in caſe their lands are not already watered, it is no ſmall advantage to have a new canal brought through them, as they have the opportunity of buying water of the proprietors. It is ſold per hour per week; and even half an hour, and down to a quarter. The common price of an hour per week, for ever, is 1500 liv." Culture of Graſs.

SECT.

Rotation of Crops.

SECT. V.

ROTATION OF CROPS.

Importance of a proper rotation of crops.

IT is moſt juſtly obſerved by Mr Young* that "there is no circumſtance which ſo ſtrongly diſtinguiſhes the knowledge of the preſent age in the theory and practice of huſbandry, in compariſon with that of all preceding periods, as this of the right arrangement of the crops cultivated on arable land. Compared with this, all other articles are of very little importance. Unleſs this part of the farmer's conduct be well underſtood, the greateſt exertion and improvement in other branches of his buſineſs loſe their effect; and a nation finds the cultivation of its territory producing wealth and proſperity almoſt exactly in proportion to the intelligence with which its huſbandmen obſerve this leading principle of the art. As the difference between good and bad farmers depends more on this point than on any other, ſo the difference between well and ill cultivated countries is almoſt wholly reſolvable into the effects derived from the rotation of crops."

The object of the art of agriculture is to make the ſoil permanently yield the largeſt poſſible quantity of valuable produce in the ſhorteſt poſſible period of time. To accompliſh this object, however, it is neceſſary to take

* *Travels*, vol. ii.

take care that in our haſte to obtain large quantities of a favourite product, we do not injure the future productive powers of the ſoil, or kill the gooſe to obtain immediately its whole golden eggs. As the moſt valuable crops always do, in ſome degree, diminiſh the future fertility of the land, meaſures muſt be adopted for reſtoring that fertility by other crops. It is alſo neceſſary to avoid uſing in repeated ſucceſſion ſuch crops as are injurious mechanically to the fertility of the ſoil, by binding it, or rendering it ſtiff and impervious to the roots of grain or other plants. It is farther requiſite, that ſuch a ſucceſſion of crops be obſerved as may have a tendency to prevent the growth, or to promote the extirpation, of thoſe natural plants in which the ſoil delights, but which are of no uſe to man. The nice point is, to intermix crops, ſo as to make the greateſt profit conſiſtently with keeping the ground in proper order. In that view, the nature of the plants employed in huſbandry muſt be accurately examined. Rotation of Crops.

The difference between culmiferous and leguminous plants, was occaſionally mentioned above. With reſpect to the preſent ſubject, a cloſer inſpection is neceſſary. Culmiferous plants, having ſmall leaves and few in number, depend moſtly on the ſoil for nouriſhment, and little on the air. During the ripening of the ſeed, they draw probably their whole nouriſhment from the ſoil; as the leaves by this time, being dry and withered, muſt have loſt their power of drawing nouriſhment from the air. Now, as culmiferous plants are chiefly cultivated for their ſeed, and are not cut down till the ſeed be fully ripe, they may be pronounced all of them to be robbers, ſome more, ſome leſs. But ſuch plants, while young, are all leaves; and in that ſtate reſemble Culmiferous and leguminous plants.

leguminous

Rotation of Crops.

leguminous plants. Hence it is, that when cut green as food for cattle, a culmiferous crop is far from being a robber. A hay-crop, accordingly, even where it conſiſts moſtly of rye-graſs, is not a robber, provided it be cut before the ſeed is formed; which at any rate it ought to be, if we would have hay in perfection. And the foggage, excluding the froſt by covering the ground, keeps the roots warm. A leguminous crop, on the contrary, when cut green for food, muſt be extremely gentle to the ground. Peas and beans are leguminous plants: but being cultivated for ſeed, they ſeem to occupy a middle ſtation: their ſeed makes them more ſevere than other leguminous crops cut green; their leaves, which grow till reaping, make them leſs ſevere than a culmiferous plant left to ripen.

Theſe plants are diſtinguiſhed no leſs remarkably by the following circumſtance. All the ſeeds of a culmiferous plant ripen at the ſame time. As ſoon as they begin to form, the plant becomes ſtationary, the leaves wither, the roots ceaſe to puſh, and the plant, when cut down, is blanched and ſapleſs. The ſeeds of a leguminous plant are formed ſucceſſively: flowers and fruit appear at the ſame time in different parts of the plant. This plant accordingly is continually growing, and puſhing its roots. Hence the value of bean or peaſe ſtraw above that of wheat or oats: the latter is withered and dry when the crop is cut; the former, green and ſucculent. The difference, therefore, with reſpect to the ſoil, between a culmiferous and leguminous crop, is great. The latter, growing till cut down, keeps the ground in conſtant motion, and leaves it to the plough looſe and mellow. The former gives over growing long before reaping; and the ground, by want

of

of motion, turns compact and hard. Nor is this all: Dew falling on a culmiferous crop after the ground begins to harden, reſts on the ſurface, and is ſucked up by the next ſun. Dew that falls on a leguminous crop is ſhaded from the ſun by the broad leaves, and ſinks at leiſure into the ground. The ground accordingly, after a culmiferous crop, is not only hard, but dry: after a leguminous crop, it is not only looſe, but ſoft and unctuous. Rotation of Crops.

Of all culmiferous plants, wheat is the moſt ſevere, by the long time it occupies the ground without admitting a plough. And as the grain is heavier than that of barley or oats, it probably requires more nouriſhment than either. It is obſerved above, that as peas and beans draw part of their nouriſhment from the air, by their green leaves, while allowed to ſtand, they draw the leſs from the ground; and by their conſtant growing they leave it in good condition for ſubſequent crops. In both reſpects they are preferable to any culmiferous crop.

Culmiferous crops, as obſerved above, are not robbers when cut green: the ſoil, far from hardening, is kept in conſtant motion by the puſhing of the roots, and is left more tender than if it had been left at reſt without any bearing crop.

Bulbous-rooted plants are, above all, ſucceſsful in dividing and pulverizing the ſoil. Potato-roots grow ſix, eight, or ten inches under the ſurface; and, by their ſize and number, they divide and pulverize the ſoil better than can be done by the plough: conſequently, whatever be the natural colour of the ſoil, it is black when a potato-crop is taken up. The potato, however, with reſpect to its quality of dividing the

ſoil,

Rotation of Crops.

ſoil, muſt yield to a carrot or parſnip; which are large roots, and pierce often to the depth of 18 inches. The turnip, by its tap-root, divides the ſoil more than can be done by a fibrous-rooted plant; but as its bulbous root grows moſtly above ground, it divides the ſoil leſs than the potato, the carrot, or the parſnip. Red clover, in that reſpect, may be put in the ſame claſs with turnip.

General principle.

The reſult of the whole is what follows: Culmiferous plants are robbers; ſome more, ſome leſs: they at the ſame time bind the ſoil; ſome more, ſome leſs. Leguminous plants in both reſpects are oppoſite: if any of them rob the ſoil, it is in a very ſlight degree; and all of them without exception looſen the ſoil. A culmiferous crop, however, is generally the more profitable: but no ſoil can long bear the burden of ſuch crops, unleſs relieved by interjected leguminous crops. Theſe, on the other hand, without a mixture of culmiferous crops, would ſoon render the ſoil too looſe.

Preparatory crops.

As formerly mentioned, ſome crops are rendered extremely valuable from their tendency to produce another crop of a different, but more valuable, kind on the ſucceeding year. Thus the land is excellently prepared for producing wheat by means of a crop of drilled beans; and ſome lands are ſtill better prepared for the ſame object by a crop of clover, the wheat to be ſown upon the clover ley once ploughed. In like manner, turnips, as formerly noticed, are found to afford the beſt poſſible preparation for a crop of barley.

The great error into which our forefathers ran in their agriculture conſiſted of ſowing too frequently in ſucceſſion that kind of grain of which they wiſhed to poſſeſs abundance. It is now found that no greater er-

ror

ror than this could poſſibly be committed. The more wheat, for example, that a farmer ſows, the more he does not reap. On the contrary, that land which is kept in proper order will yield a greater quantity of grain when ſown but once in four years, than it would do with inferior huſbandry if ſown every third year; and it is certain, that if wheat, oats, or barley, were ſown upon the ſame ſpot every year, the land in a ſhort time would not yield the ſeed. Rotation of Crops.

That rotation of crops is undoubtedly the beſt, which has the moſt complete tendency to accompliſh the great objects of agriculture; that is, to enrich the ſoil by abundance of manure, to preſerve it clear of weeds, and to pulverize it when its mechanical quality is ſtiff, and to give it denſity and tenacity where it is too light. To accompliſh theſe objects, the general rule is, that the ſoil ought to be employed alternately in rearing grain as food for man, and in rearing food for cattle. The crops which are moſt valuable as food for cattle, have all a tendency to ameliorate the ſoil. When they conſiſt of graſs, they prepare a turf which, when broken up by the plough, affords the moſt excellent of all manures, while at the ſame time, by remaining in the ſtate of paſture, a looſe ſoil ſpeedily acquires firmneſs and tenacity. When the crops reared to feed cattle conſiſt of roots, ſuch as turnips, or plants, ſuch as cabbages or beans, they afford an excellent opportunity at once for pulverizing and cleaning the ſoil by repeated hoeings. When theſe crops conſiſt of peaſe, beans, ſown broadcaſt, or tares, or cabbages, the cloſe covering which they afford to the ſoil, ſmothers all weeds, and leaves the land in a ſtate of increaſed fertility. Importance of providing food for cattle.

As a general principle, therefore, it is impoſſible to urge

Rotation of Crops.

urge too ſtrongly upon perſons engaged in agriculture, the importance of rearing and providing food for large quantities of cattle: In this way the ſoil never fails to produce larger quantities of grain than it would otherwiſe have done; but, at the ſame time, the whole butcher's meat, cheeſe, milk, butter, wool, and leather, are ſo much clear additional produce gained from the land; by means of which the wealth of the country and its power of providing for a numerous population is enormouſly increaſed. The neceſſity of rearing cattle upon a farm, like every general rule, no doubt, admits of exceptions. In the neighbourhood of great cities immenſe quantities of dung may perhaps be procured, which may ſuperſede the neceſſity of its being prepared in farm yards. In ſuch a caſe the whole crop of corn, hay, and roots, may perhaps be ſafely ſold off from the farm every year; but this is only to be allowed, becauſe, in ſuch a ſituation, the farmer has an opportunity of purchaſing, what in the general caſe, muſt be provided at home. Upon this ſubject Mr Young judiciouſly remarks, * that "that country, that farm, will be moſt improved and moſt productive, upon which the greateſt quantity of cattle and ſheep is kept. This holds good of an acre, a field, a farm, a diſtrict, a province, or a kingdom. This point, of ſuch infinite and national importance, depends abſolutely on the courſe of crops. Reiterated and ſatisfactory experiment has proved, that two crops of white corn ought not to come together. Inſtances may poſſibly be quoted to the contrary; but, to reaſon on particular exceptions, would

* *Travels*, vol. i.

would be endleſs. If this rule be broken, it is generally at the expence of cattle and ſheep, and of dung; and whatever is purchaſed at that expence is purchaſed dearly. Out of ſuch a maxim, the right conduct riſes naturally: it ſuppoſes corn and cattle crops alternately; part of the arable, therefore, maintains cattle, and part yields corn. This will decide the nature of the crop; for cattle and ſheep muſt be ſupported in winter as well as in ſummer; the crops for each ſeaſon muſt, therefore, be proportioned to each other, and the arragement muſt be ſuch as preſerves the land clean. It would be evidently uſeleſs to take notice of the variety of caſes that may admit variations, without militating againſt the leading principles of ſuch a deduction. Land may be ſo rich as to want neither cattle or ſheep; it may, like ſome on the Garonne in France, produce hemp and wheat for ever; it may be ſo near a great city, that purchaſed manure may make other courſes more eligible; certain crops may be in ſuch demand, as to make it deſireable to cultivate them by way of fallow, though not for cattle or ſheep, as cole-ſeed for oil, tobacco, flax, and other articles. Such exceptions, which, in the nature of things, muſt be numerous, are in no reſpect contrary to the leading principles that ought to govern throughout this inquiry. For, the winter ſupport of cattle and ſheep there are turnips, cabbages, potatoes, rape, carrots, parſnips, beans, vetches; for the ſummer ſuſtenance, cultivated graſſes of all kinds, which ſhould neceſſarily be adapted to the quality of ſoil, and to laſt in proportion to the poverty of it, and to the nature of the graſs. Hence then ſome courſes arrange themſelves that are applicable, perhaps, to all the ſoils of the world.

Rotation of Crops.

Rotation of Crops.

1. Roots, cabbage, or pulſe.
2. Corn.
3. Graſſes.
4. Corn.

And 1. Roots or cabbage.
2. Corn.
3. Graſſes.
4. Pulſe or maize, hemp or flax.
5. Corn.

And in theſe the chief diſtinction relative to ſoil will be the number of years in which the graſſes are left: theſe are various in particular caſes, but the number is inconſiderable."

Having thus ſtated the general principles upon which the rotation of crops ought to proceed, and which the judicious farmer muſt apply to the circumſtances of his own particular caſe, we proceed to give examples of ſpecific rotations that have been recommended by the practice of ſucceſsful agriculturiſts. The laſt-quoted writer, Arthur Young, Eſq. made no leſs than thirty-ſix different experiments of a ſix years rotation, of which he has publiſhed the reſult *. The ſoil was a ſandy loam on a clay marl bottom, very wet naturally, but rendered dry by hollow-drains made ſome years back. It had been long under graſs, and was worth 10s. an acre rent, but had been improved, and let at 20s.; after which the tenant had brought it down to the value of 15s. an acre, in which ſtate it was when a field was divided in 1787, into thirty-ſix parts or ſquares, and the courſe of experiments begun. We ſhall

Experiments by Mr Young.

* *Annals of Agriculture*, vol. xxiii.

I shall not here recite the various rotations deviſed and put in practice on the above occaſion, by this ingenious and juſtly celebrated agriculturiſt; but ſhall ſtate for the inſtruction of the reader the following inferences, drawn by him from the whole courſe of experiments. In theſe it will be obſerved, that all hoed crops are denominated fallow crops, as being ſubſtituted for the old practice of summer fallows. Rotation of Crops.

I. "That potatoes exhauſt more than any other fallow crop tried; much more even than barley, and more even than wheat in ſome courſes.

II. "That potatoes will not yield a tolerable crop even on old ley, newly broken up, on ſuch a ſoil, without the aid of dung; and not a profitable crop even with it.

III. "That barley, beans, and oats, ſucceed much better than wheat after potatoes.

IV. "That beans are the moſt valuable fallow crop on new land of this quality.

V. "That the preſervation of the fertility of old turf depends greatly on the number of bean crops introduced; the oftener they are planted, the better the ſucceeding crops of white corn; and that three ſucceſſive years of beans are attended by an extraordinary produce of wheat.

VI. "That beans and barley alternately, and beans and wheat alternately, are both courſes of great produce and profit.

VII. "That the introduction of beans, in bad rotations, tends to remedy the evil of ſuch rotations.

VIII. "That ſucceſſive crops of white corn are deſtructive of that fertility which different rotations will preſerve in new ground; and that three ſuch will re-

Rotation of Crops.

duce the land to a foul and moſt unprofitable co[illegible]tion.

IX. "That the two moſt productive courſes are beans and barley alternately, and beans and wheat alternately; the former the moſt productive, but the latter moſt profitable from ſaving of tillage.

X. "That four crops of beans and one of wheat, even with the drawback of one year's cabba[illegible] courſe of profit; and the land left in ſuch order as to make it perhaps the firſt.

XI. "That the moſt unproductive, and in a yet greater degree the moſt unprofitable courſes, are thoſe in which turnips, cabbages, and potatoes, the moſt often occur.

XII. "That oats are on ſuch new land the beſt white crop that can be ſown, yielding a very extraordinary produce and profit."

Mr Young gives the following opinion upon the whole: "I am inclined to think, that ſuch a courſe as this would prove the moſt profitable:—1. Beans; 2. oats; 3 beans; 4. oats; 5. beans; 6. oats; 7. clover; 8. beans; 9. wheat; becauſe the profit of beans in every rotation in which the ſoil was not exhauſted is deciſive; becauſe oats, while the old turf is decaying, are far more productive than either barley or wheat; becauſe clover would revive the fertility which beans, in the eighth year, would not leſſen, and wheat after thoſe two ſucceſſive ameliorating crops would not fail of yielding a handſome produce. I recommend ſuch a rotation, however, for new land only."

Alternate corn and graſs.

There is an alternate huſbandry of graſs and corn which poſſeſſes great advantages, and is very profitable, as, by laying moſt kinds of land to graſs, and by paſturing

ing them, eſpecially with ſheep, they are prepared in the beſt manner for corn. This kind of huſbandry is adopted in many parts both in Scotland and England. The Rev. Arthur Young recommends the following rotations to be adopted for it. Rotation of Crops.

On Soils inclinable to moiſture or of good Fertility.	On dry Land.
1. Oats.	1. White peaſe and turnips.
2. Turnips.	2. Barley.
3. Barley.	3. Clover.
4. Clover or winter tares.	4. Wheat.
5. Wheat.	5. Turnips.
6. Turnips.	6. Barley.
7. Barley.	7. Graſs for three years.
8. Graſs for three or four years.	

" Loam in graſs break up with, 1. oats; 2. turnips; 3. barley; 4. graſs; 5. graſs; 6. graſs: or, 1. turnips; 2. barley; 3. clover; 4. wheat; 5. turnips; 6. barley; 7. graſs; 8. graſs; 9. graſs; 10. graſs. —Wet loams break up with, 1. oats; 2. beans; 3. wheat; 4. fallow and graſs; 5. graſs; 6. graſs; 7. graſs; 8. graſs.

" Such huſbandry muſt keep land in a conſtant ſtate of fertility."

The ſame author obſerves, that " this alternate huſbandry appears to be well underſtood in Northumberland. By means of three years graſs, depaſtured with ſheep, the land will grow good crops of oats, which they could never get it to do under their old ſyſtem; ſoil ſandy and dry light loams. Various ſyſtems have been tried in Northumberland, particularly the boaſted courſes of, 1. turnips; 2. barley; 3. clover; 4. wheat;

Rotation of Crops.

till the crops have evidently declined, particularly the turnips and clover; and the only means of reſtoring ſuch lands has been in the ſyſtem of three years arable and three years graſs, depaſtured by ſheep: by this mode nature has time to prepare a ſufficient lea-clod, which being turned up for the turnip fallow, will inſure a vigorous crop of turnips; as it is well known that they always flouriſh upon freſh land, or [illegible] the remains of a lea-clod to vegetate in. The portion that is kept in graſs for three years breeds and fattens ſuch a number of ſheep as leaves a conſiderable profit, probably equal to, if not more than, the arable crops, the yearly profits of a ſheep being eſtimated at not leſs than 20s. or 30s. ſix or eight of which an acre of clover will fatten, and an acre of turnips about double the number." This is to the credit of the Northumberland drill ſyſtem, or the ſoil muſt be very extraordinary. "By this ſyſtem (the author goes on) are obtained the principal advantages of folding, without any of its inconveniences."

In conſequence of the premiums offered by the Board of Agriculture for eſſays upon the beſt mode of breaking up paſture lands, and of reſtoring them to graſs, without injury, a great variety of excellent rotations were ſuggeſted. The Rev. Mr Arthur Young, above quoted, propoſes for clay ſoils the following rotations: "With paring and burning, and for four years tillage:—1. Pare and burn for cole or cabbage, to be fed on the land with ſheep; 2. beans; 3. wheat; 4. fallow and graſs.

Rev. Mr Young on rotations.

"For ſix years tillage:—1. Cole; 2. beans; 3. wheat; 4. beans; 5. wheat; 6. fallow and graſs. The beans ought

ought to be dibbled one row on every other furrow, and thoroughly horſe and hand-hoed. Rotation of Crops.

"*Without paring and burning.*—Break up the old graſs by one earth, and dibble in, 1. beans; 2. oats; 3. clover; 4. beans; 5. wheat; 6. fallow and graſs.

"If as much wheat as poſſible be in contemplation:

1. Beans.
2. Wheat.
3. Beans.
4. Wheat.
5. Fallow and graſs.

5. Beans.
6. Wheat.
7. Fallow and graſs.

On *loam* the ſame writer recommends the following among other rotations:—"1. Oats dibbled; 2. turnips; 3. barley; 4. clover; 5. wheat; 6. turnips; 7. barley and graſs; or either of the two following:

1. Pare and burn for turnips.
2. Turnips.
3. Barley.
4. Clover.
5. Wheat.
6. Turnips.
7. Barley and graſs.

1. Pare and burn for turnips.
2. Barley.
3. Clover.
4. Wheat.
5. Turnips.
6. Turnips.
7. Barley and graſs.

"In proportion to the dryneſs and lightneſs of the loam white peaſe are applicable:—1. Peaſe dibbled; 2. wheat; 3. turnips; 4. barley; 5. clover; 6. wheat; 7. turnips; 8. barley and graſs.

"Potatoes are admiſſible; but as they exhauſt, they are to be guarded by a courſe which afterwards repleniſhes:—1. Potatoes; 2. barley; 3. clover; 4. wheat; 5. turnips; 6. turnips; 7. barley and graſs."

For a ſandy ſoil the ſame writer recommends, in general, the following rotations: "1. Turnips; 2. barley;

Rotation of Crops.

3. grafs; 4. grafs; 5. grafs; 6. white peafe; 7. white, barley, or oats: or, 1. turnips; 2. barley; 3, 4, 5, and 6, grafs; 7. peafe; 8. turnips; 9. barley."

On a chalky foil, called in England *downs*, *wolds*, &c. he recommends, "1. Pare and burn for turnips; 2. turnips; 3. barley; 4. clover; 5. wheat; 6. turnips; 7. turnips; 8. barley; 9. fainfoin for not lefs than ten years."

Upon peat he propofes, 1. Turnip, cabbage, or cole; 2. oats; 3. turnip, cabbage, or cole; 4. oats and grafs: or continued to 8 years, by 5. clover; 6. wheat; 7. turnips, cabbage, or cole; 8. oats and grafs.

"Potatoes are admiffible; but, as they exhauft, are to be guarded by, 1. Pare and burn for potatoes; 2. oats; 3. turnip-cabbage, or cole; 4. ditto; 5. oats and grafs."

Rotation by Mr Clofe.

The Rev. H. J. Clofe, a zealous adherent of the drill hufbandry, in the eflay already quoted, gives the following view of a courfe of crops adapted to various foils for any number of years.

Clay.

Clay.	Turnips or Cabbages.	Oats.	Beans and Clover.	Wheat.	Turnips or Cabbages.	Oats.	Beans and Vetches.	Wheat.
Clayey Loams.	Ditto.	Ditto.	Clover.	Ditto.	Ditto.	Barley.	Beans.	Wheat.
Rich Loams or Sandy Loams.	Turnips & Potatoes.	Barley.	Clover.	Ditto.	Beans.	Ditto.	Peaſe.	Ditto.
	Beans.	Ditto.	Peaſe	Ditto.	Ad infinitum.			
	Turnips.	Ditto.	Clover.	Ditto.	Potatoes.	Barley.	Peaſe.	Wheat.
Peat Earth.	Turnips.	Ditto.	Ditto.	Ditto.	Ditto.	Ditto.	Ditto.	Ditto.
Chalky Subſtratum.*	Ditto.	Ditto.	Ditto.	Ditto.	Potatoes.	Ditto.	Ditto.	Ditto.
Gravels.	Ditto.	Ditto.	Ditto.	Ditto.	Potatoes.	Barley.	Peaſe.	Wheat.
Light Lands.	Ditto.	Ditto.	Clover & Rye-graſs.	Clover & Rye-graſs.	Clover & Rye-graſs.	Peaſe.	Wheat or Rye.	

* On this ſoil ten acres on every hundred ſhould be laid with ſainfoin for eight or ten years.

" This courſe of huſbandry is only recommended, on condition that the crops are all hoed well and kept perfectly clean; and that turnips, peaſe, and beans, be put in double rows on three-feet ridges, and the cabbages in ſingle rows of three-feet ridges."

Rotation of Crops.

Rotation of Crops.

In Scotland, in high expoſed ſituations upon gravelly ſoils, accounted unfit for wheat on account of the climate, the following rotation upon cattle farms is underſtood to be ſucceſsful: 1. Turnips eaten by cattle and ſheep in a cloſe for making dung; 2. barley or oats; 3. clover fed down early with ſheep and lambs, afterwards cut for hay in the end of ſummer; 4. oats; 5. turnips, &c.

Scotiſh rotations.

In the neighbourhood of towns, where manure can be purchaſed, the above rotations will not be conſidered as applicable, as one great object they have in view is the preparation of dung. Where this is not a part of the farmer's employment, in conſequence of the opportunity of purchaſe, turnips, cabbages, &c. will naturally be neglected, and he will endeavour to produce either human food or hay, &c. for the great numbers of horſes that are now kept in cities as objects of luxury. Accordingly, in the neighbourhood of Edinburgh, the following is not an unfrequent rotation: 1. Fallow without dung, or potatoes with dung, where the ground is light or dry; 2. wheat; 3. beans dunged, drilled on light land, broadcaſt on the heavy; 4. wheat; 5. barley; 6. and 7. clover and rye-graſs hay; 8. oats; 9. fallow, or potatoes with dung.

In a tour through Suſſex, the Rev. Arthur Young mentions*, with juſt approbation, the following rotation as uſed in a part of that county: "1. Turnips; 2 barley; 3. clover; 4. wheat; 5. peaſe. If their land be in good order, it has only a ſingle ploughing for wheat, but in wet ſummers, more; the land being ſubject to couch-graſs."

It will be obſerved, that in the examples hitherto given of rotations, we have endeavoured, as far as poſſible,

* *Annals of Agriculture*, vol. xxvii.

ſible to exclude thoſe in which fallow is uſed, becauſe we are ſatisfied, that agriculture is only brought to its higheſt poſſible perfection in proportion to the degree in which fallows are exchanged for drilled green crops, which clean the land; while, at the ſame time, by affording ſubſiſtence for cattle, they beſtow the means of enriching it. As the ſtiff clay ſoil, however, which ſo much abounds in our country, renders the drill ſyſtem in many ſituations extremely difficult, and the conſumption of turnips upon the field altogether impracticable, it is not wonderful that fallows are ſtill uſed extenſively, and even conſidered as neceſſary. Neither do we think, that a ſyſtem ſhould raſhly be relinquiſhed which has been approved of for ages, and which, in the hands of ſkilful and induſtrious men, is attended with no ſmall profit. We ſhall, therefore, ſtate an example or two of rotations with fallow upon a clay ſoil. We ſhall begin with the example of a farmer who has 90 acres of a clay ſoil. Of theſe, ſix acres are to be encloſed for a kitchen garden, in which there muſt be annually a crop of red clover, for ſummer food to the working cattle As there are annually 12 acres in hay, and 12 in paſture, a ſingle plough with good cattle will be ſufficient to command the remaining 60 acres.

Rotation of Crops.

Fallow requiſite on clay ſoils.

Rotations in a clay Soil.

Inclo.	1795.	1796.	1797.	1798.	1799.	1800.
1.	Fallow.	Wheat.	Peaſe.	Barley.	Hay.	Oats.
2.	Wheat.	Peaſe.	Barley.	Hay.	Oats.	Fallow.
3.	Peaſe.	Barley.	Hay	Oats.	Fallow.	Wheat.
4.	Barley.	Hay.	Oats.	Fallow.	Wheat.	Peaſe.
5.	Hay.	Oats.	Fallow.	Wheat.	Peaſe.	Barley.
6.	Oats.	Fallow.	Wheat.	Peaſe.	Barley.	Hay.
7.	Paſture.	Paſture.	Paſture.	Paſture.	Paſture.	Paſture.

When

Rotation of

When the rotation is completed, the ſeventh inclo-ſure, having been ſix years in paſture, is ready to be taken up for a rotation of crops which begins with oats in the year 1801, and proceeds as in the ſixth incloſure. In the ſame year 1801 the fifth incloſure is made paſture, for which it is prepared by ſowing paſture-graſs ſeeds with the barley of the year 1800. And in this manner may the rotation be carried on without end. Here the labour is equally diſtributed; and there is no hurry nor confuſion. But the chief property of this rotation is, that two culmiferous or white-corn crops are never found together; by a due mixture of crops, the ſoil is preſerved in good heart without any adventitious manure. At the ſame time, the land is always producing plentiful crops: neither hay nor paſture get time to degenerate. The whole dung is laid upon the fallow.

Every farm that takes a graſs crop into the rotation muſt be incloſed, which is peculiarly neceſſary in a clay ſoil, as nothing is more hurtful to clay than poaching.

In addition to theſe, we ſhall here ſtate, from the Agricultural Survey of Yorkſhire, an example of a rotation uſed in that county upon a marſh-land farm conſiſting of 432 acres of arable land, in which a very great number of hands and horſes appear to have been employed, but in which very valuable products are reared. "The ſoil, where the principal part of the potatoes are grown, is a good warp; the other part on which potatoes are alſo cultivated, a mixture of warp and ſand: the remainder of the land, clay, with a ſmall portion of warp, but too ſtrong to grow potatoes, except about 70 acres, which is tolerable good potato-land,

Marſh-land rotation.

land, but at too great a diſtance from the river. Graſs land only ſufficient to keep two milch cows, and horſes neceſſary for working the farm: 69 acres of the beſt warp land divided into three equal parts: 1. fallow, with from 16 to 20 loads of manure per acre; ſet it with potatoes; after ſow wheat; and then fallow again: three acres of the ſame kind of land that is liable to be damaged by ſparrows when ſown with corn, is ſet with potatoes every year with about 10 loads of manure per acre each year: 84 acres of the lighter land is divided in the ſame manner, one-third fallow, with 10 loads of manure per acre; ſet potatoes and then ſow wheat, and fallow again: 42 acres of land, lately an old paſture, divided into three parts; one-third flax, then ſown with rape, and after they come off, plough and harrow the land three or four times, and lay upon it about 20 loads of manure per acre, which will make it in great condition; after which ſet potatoes, then ſow flax again, and rape after: 150 acres divided into three parts; 1. fallow; 2. wheat; 3. beans, drilled at 9 inches diſtance, hand-hoed twice at 6s. per acre; fallow again, &c.: 80 acres of land that was lately in old graſs divided into four parts; fallow, wheat, beans drilled, and oats; then fallow again, &c. The remaining four acres thrown to any of the crops that are likely to fail. Rent 25s. per acre; aſſeſſments 5s. per acre. Rotation of Crops

Rotation of Crops.

"*Diſtribution of Crops for* 1795.

	Acres.	Average Produce of an Acre.
Wheat, - -	121	from 3 to 5 quarters.
Beans, - -	70	from 3 to 6 quarters.
Oats, - -	20	from 6 to 10 quarters.
Flax, - -	14	from 45 to 55 ſtones.
Rape, - -	14	from 5 to 5 quarters.
Potatoes, - -	68	from 60 to 100 ſacks.
Fallow, - -	121	
To be thrown where a crop is likely to fail,	4	
	432	

"*Servants, Horſes, and Cows kept upon the Farm.*

4 Houſe ſervants,
16 Labourers,
26 Horſes,
2 Milch cows.

"The above is an account of a farm belonging to one of the beſt managers of marſh-land. We muſt obſerve, he fallows his land very often; yet he is well paid by his ſuperior crops. The laſt year (1795) he had 100 ſacks per acre off moſt of his potato-land; and ſold them from 8s. to 12s. per ſack of 14 pecks. All their corn is ſold by the quarter of eight Wincheſter buſhels, though I believe their meaſure rather overruns."

SECT.

Reaping and Storing up Corn and Hay.

SECT. VI.

OF REAPING CORN AND HAY CROPS, AND STORING THEM UP FOR USE.

Of ripeneſs.

CULMIFEROUS plants are ripe when the ſtem is totally white: they are not fully ripe if any green ſtreaks remain. Some farmers are of opinion, that wheat ought to be cut before it is fully ripe. Their reaſons are, firſt, that ripe wheat is apt to ſhake; and next, that the flour is not ſo good. With reſpect to the laſt, it is contrary to nature, that any ſeed can be better in an unripe ſtate than when brought to perfection; nor will it be found ſo upon trial. With reſpect to the firſt, wheat, at the point of perfection, is not more apt to ſhake than for ſome days before: the huſk begins not to open till after the ſeed is fully ripe; and then the ſuffering the crop to ſtand becomes tickliſh; after the minute of ripening, it ſhould be cut down in an inſtant, if poſſible.

Of reapers.

This leads to the hands that are commonly engaged to cut down corn. In Scotland, the univerſal practice was, to provide a number of hands, in proportion to the extent of the crop, without regard to the time of ripening. By this method, the reapers were often idle for want of work; and what is much worſe, they had often more work than they could overtake, and ripe fields were laid open to ſhaking winds. The Lothians have long enjoyed weekly markets for reapers where a farmer

Reaping and Storing up Corn and Hay

farmer can provide himſelf with the number he wants; and this practice is creeping into neighbouring ſhires. Where there is no opportunity of ſuch markets, neighbouring farmers ought to agree in borrowing and lending their reapers.

One ſhould imagine, that a caution againſt cutting corn when wet is unneceſſary; yet from the impatience of farmers to prevent ſhaking, no caveat is more ſo. Why do they not conſider, that corn ſtanding dries in half a day; when, in a cloſe ſheaf, the weather muſt be favourable if it dry in a month? in moiſt weather it will never dry.

Manner of cutting.

With reſpect to the manner of cutting, we muſt premiſe, that barley is of all the moſt difficult grain to be dried for keeping. Having no huſk, rain has an eaſy acceſs; and it has a tendency to malten when wet. Where the ground is properly ſmoothed by rolling, it ſeems beſt to cut it down with the ſcythe. This manner being more expeditious than the ſickle, removes it ſooner from danger of wind; and gives a third more ſtraw, which is a capital article for dung, where a farm is at a diſtance from other manure. We except only corn that has lodged; for there the ſickle is more convenient than the ſcythe. As it ought to be dry when cut, bind it up directly; if allowed to lie any time in the ſwath, it is apt to be diſcoloured.—Barley ſown with graſs-ſeeds, red clover eſpecially, requires a different management. Where the graſs is cut along with it, the difficulty is great of getting it ſo dry as to be ventured in a ſtack. The beſt way is, to cut the barley with a ſickle above the clover, ſo as that nothing but clean barley is bound up. Cut with a ſcythe the ſtubble and graſs: they make excellent winter food. The ſame

method

method is applicable to oats; with this only difference, that when the field is expoſed to the ſouth-weſt wind, it is leſs neceſſary to bind immediately after mowing. As wheat commonly grows higher than any other grain, it is difficult to manage it with the ſcythe; for which reaſon the ſickle is preferred in England. Peaſe and beans grow ſo irregularly, as to make the ſickle neceſſary. Reaping and Storing up Corn and Hay.

" Some time ago, an experiment was made in Eaſt Lothian to aſcertain the difference betwixt high and low cutting. Four ridges of wheat were cut, which were of equal length and breath, and apparently the ſame in quality. Two of them were cut cloſe by the ground, and the other two conſiderably higher, though not ſo high as in many places of the weſt riding. The meaſure of each two ridges was a very trifle more than a quarter of a Scotch acre, which is one-fifth more than the Engliſh ſtatute meaſure. The low cutting was done by eight reapers in an hour and twenty-four minutes; the high cutting in forty-eight minutes by the ſame hands. The wheat was thraſhed ſeparately, and the corn and ſtraw meaſured and carefully weighed.

Reſult. Eight reapers, 1 hour 24 minutes, at 1 s. 6d. per day (being the rate of wages that week), and 6d. for victuals, is 2s. per day, - -	L.	—	2 4
The high cutting, by the ſame hands, 48 minutes, at ditto or 4s. per Scots acre,		—	1 4
Difference of expence,		—	1 0

Reaping and Storing up Corn and Hay.

1½ Peck more wheat upon the two ridges, low cut, than upon thoſe cut high, at 1s. 4d. per peck, is - - — 1 8

14 Stone (of 22 Engliſh pounds) more ſtraw, at 2d. per ſtone, - - — 2 4

— 4 0

From which deduct the difference of expence in cutting, - - — 1 0

— 3 0

"Benefit derived from cutting low being 3s. the quarter of an acre, or 12s. per acre."

Scythes recommended.

In the Tranſactions of the Patriotic Society of Milan, an attempt is made to recommend the uſe of the ſcythe in reaping grain, to the entire excluſion of the ſickle. It is obſerved, that "it has been a queſtion in agriculture, whether ſcythes or ſickles were moſt advantageouſly uſed for reaping corn. All perſons agree, that much more work, and with leſs labour, may be done with the ſcythe than with the ſickle; but ſome ſay, that the ſaving of time and labour is not ſufficient to compenſate the diſadvantages attending that method

"It is ſaid, that the ſcythe ſhakes the ear, ſo that many of the grains are loſt; that it lets the corn fall, after cutting it, in a confuſed and ſcattered ſtate, ſo that either much of it is loſt, or a great deal of time is conſumed in gathering it together; that it can only be made uſe of in land which is very even and free from ſtones; that it does not leave ſufficient length of ſtubble in the ground to lay the corn on when cut; that it mixes bad weeds with the corn, the ſeeds of which are ſown the

the next year; and laſtly, that the uſe of the ſcythe is prejudicial to the health of the reaper. Reaping and Storing up Corn and Hay.

"Theſe objections, however, are either of no weight, or they are made by thoſe who are not acquainted with the good ſcythes which have been adapted to this purpoſe, and with the proper manner of uſing them. With a good ſcythe, properly managed, the corn, after being cut, remains at firſt upright, and then falls very gently upon the rake fixed to the ſcythe, without any ſhake or jolt; or at leaſt with leſs than that it receives when reaped with a ſickle. With reſpect to the loſs of grain, that proceeds chiefly from the corn being too dry; conſequently it ſhould be reaped only upon proper days and proper times of the day, which is much more eaſily done with the ſcythe than with the ſickle, becauſe the work is ſo much ſhorter; the ſtalks kept together by the rake may be laid upon the ground, or rather againſt the corn not yet cut, in ſo regular and collected a ſtate, that thoſe who gather and tie the ſheaves, whether they are women or children, have nothing but their own negligence to accuſe, if any thing is left behind. When land is properly ploughed and harrowed, it is ſufficiently even; and in ſuch as is ſtony, the only precaution neceſſary is to keep the ſcythe a little higher in uſing it, that it may not ſtrike againſt the ſtones. If the ſtubble left in the ground be ſhort, the ſtraw which is cut off will be the longer; and the latter is certainly of more value than the former, which only ſerves to incommode the cattle which afterwards go to feed in the field. If the poſture and manner of uſing the ſickle be compared with the management of the ſcythe, it muſt very clearly appear, that the latter is attended with leſs inconvenience and

Reaping and Storing up Corn and Hay.

leſs danger. It is indeed true, that the workmen who uſe the ſcythe are ſometimes afflicted with diſorders in the kidneys, as Duhamel obſerves; but that inconvenience ariſes from their not keeping themſelves in a proper poſture.

Poſture in mowing corn.

"It ſhould, however, be obſerved, that, in mowing graſs, the feet are kept always parallel to each other; whereas, in reaping corn, they ſhould be kept upon a line, one behind the other, thruſting the right foot forward, and drawing the left towards it. This is neceſſary; becauſe, when graſs is mowed, it is left to fall juſt where it is cut; but, when corn is cut, it is to be carried, and laid in a proper manner againſt that which is not yet cut, and which is at the left hand of the reaper; and if the feet were kept parallel to each other, the reaper would be obliged to extend and turn his body in a very inconvenient manner."

This Society, to encourage the uſe of ſcythes, has publiſhed different figures of cradle-ſcythes, which contain nothing very particular. Upon the whole, the uſe the ſcythe ſeems to be gaining ground, in conſequence of the high price of labour, though it ought undoubtedly to be made uſe of under the limitations which we have already ſtated.

Short French ſcythe.

In ſome parts of France they uſe, with advantage, a ſcythe with a ſhort handle, of a light conſtruction, which is held in one hand only, while the other is employed in collecting the grain. Mr Young mentions it in his travels with approbation *. "The ſhort ſcythe, which they uſe through this province (Artois) and all over Flanders,

* Vol. ii.

Flanders, is one of the muſt uſeful implements that can be ſeen; they call it the *pique*. A man cuts an arpent a day in general with it, and ſometimes more; he cuts and rolls into bottes an arpent of vetches (called here, mixed with oats, *dravin*); and he cuts an arpent of any ſort of white corn, others following to bind with ſtraw bands made at home. This is a moſt economical ſyſtem. The ſhort handle of the pique is made to reſt againſt the elbow; he holds it with the right hand only, or rather hand and arm; and in his left he has a ſtick, with a hook at the end of it, with which he draws or holds the corn in the right poſition to receive the ſtroke. They uſe ſcythes and cradles alſo for ſome works. Reaping and Storing up Corn and Hay.

"*St Omer*.—That the pique is much eaſier to work than a ſcythe, appears from women and even girls cutting ſtout crops of tares with it."

The beſt way for drying peaſe, is to keep ſeparate the handfuls that are cut; though in this way they wet eaſily, they dry as ſoon. In the common way of heaping peaſe together for compoſing a ſheaf, they wet as eaſily, and dry not near ſo ſoon. With reſpect to beans, the top of the handful laſt cut ought to be laid on the bottom of the former; which gives ready acceſs to the wind. By this method peaſe and beans are ready for the ſtack in half the ordinary time. Drying of peaſe.

A ſheaf commonly is made as large as can be contained in two lengths of the corn made into a rope. To ſave frequent tying, the binder preſſes it down with his knee, and binds it ſo hard as totally to exclude the air. If there by any moiſture in the crop, which ſeldom fails, a proceſs of fermentation and putrefaction commences in the ſheaf; which is perfected in the ſtack, to the Size of ſheaves.

Reaping and Storing up Corn and Hay.

deſtruction both of corn and ſtraw. How ſtupid is it, to make the ſize of a ſheaf depend on the height of the plants! By that rule, a wheat ſheaf is commonly ſo weighty, as to be unmanageable by ordinary arms: it requires an effort to move it that frequently burſts the knot, and occaſions loſs of grain, beſide the trouble of a ſecond tying. Sheaves ought never to be larger than can be contained in one length of the plant, cut cloſe to the ground, without admitting any exception, if the plants be above 18 inches high. The binder's arm can then compaſs the ſheaf ſufficiently without need of his knee. The additional hands that this way of binding may require, are not to be regarded compared with the advantage of drying ſoon. Corn thus managed may be ready for the ſtack in a week; it ſeldom in the ordinary way requires leſs than a fortnight, and frequently longer. Of a ſmall ſheaf, compreſſed by the arm only, the air pervades every part; nor is it ſo apt to be unlooſed as a large ſheaf, however firmly bound. We omit the gathering of ſheaves into ſhocks, becauſe the common method is good, which is to place the ſhocks directed to the ſouth-weſt, in order to reſiſt the force of the wind. Five ſheaves on each ſide make a ſufficient ſtay; and a greater number cannot be covered with two head-ſheaves.

Carrying off the victual.

Every article is of importance that haſtens the operation in a country, like Scotland, ſubject to unequal harveſt weather; for which reaſon, the moſt expeditious method ſhould be choſen for carrying corn from the field to the ſtack-yard. Our carriages are generally too ſmall or too large. A ſledge is a very awkward machine: many hands are required, and little progreſs made. Waggons and large carts are little leſs dilatory,

as they muſt ſtand in the yard till unloaded ſheaf by ſheaf. The beſt way is, to uſe long carts moveable upon the axle, ſo as at once to throw the whole load on the ground; which is forked up to the ſtack by a hand appointed for that purpoſe. By this method, two carts will do the work of four or five. Reaping and Storing up Corn and Hay.

Building round ſtacks in the yard is undoubtedly preferable to houſing corn. There it is ſhut up from the air; and it muſt be exceeding dry, if it contract not a muſtineſs, which is the firſt ſtep to putrefaction. Add to this, that in the yard, a ſtack is preſerved from rats and mice, by being ſet on a pedeſtal: whereas no method has hitherto been invented for preſerving corn in a houſe from ſuch deſtructive vermine. The proper manner of building, is to make every ſheaf incline downward from its top to its bottom. Where the ſheaves are laid horizontally, the ſtack will take in rain both above and below. The beſt form of a ſtack is that of a cone placed on a cylinder; and the top of the cone ſhould be formed with three ſheaves drawn to a point. If the upper part of the cylinder be a little wider than the under, ſo much the better. Of ſtacking.

The delaying to cover a ſtack for two or three weeks, though common, is, however, exceeding abſurd; for if much rain fall in the interim, it is beyond the power of wind to dry the ſtack. Vegetation begun in the external parts, ſhuts out the air from the internal; and to prevent a total putrefaction, the ſtack muſt be thrown down and expoſed to the air every ſheaf. In order to have a ſtack covered the moment it is finiſhed, ſtraw and ropes ought to be ready; and the covering ought to be ſo thick as to be proof againſt rain. Covering the ſtacks.

Reaping and Storing up Corn and Hay.

Scotland is ſubject not only to floods of rain, but to high winds. Good covering guards againſt the former, and ropes artfully applied guard againſt the latter. The following is a good mode. Take a hay-rope well twiſted, and ſurround the ſtack with it, two feet or ſo below the top. Surround the ſtack with another ſuch rope immediately below the eaſing. Connect theſe two with ropes in an up-and-down poſition, diſtant from each other at the eaſing above five or ſix feet. Then ſurround the ſtack with other circular ropes parallel to the two firſt mentioned, giving them a twiſt round every one of thoſe that lie up and down, by which the whole will be connected together in a ſort of net-work. What remains is, to finiſh the two feet at the top of the ſtack. Let it be covered with bunches of ſtraw laid regularly up and down; the under part to be put under the circular rope firſt mentioned, which will keep it faſt, and the upper part be bound by a ſmall rope artfully twiſted, commonly called *the crown of the ſtack.* This method is preferable to the common way of laying long ropes over the top of the ſtack, and tying them to the belting-ropes, which flattens the top, and makes it take in rain. A ſtack covered in the way here deſcribed, will ſtand two years ſecured both againſt wind and rain; a notable advantage in this variable climate.

Hay-making.

The great aim in making hay is, to preſerve as much of the ſap as poſſible. All agree in this; and yet differ widely in the means of making that aim effectual. To deſcribe all the different means would be equally tedious and unprofitable. We ſhall confine ourſelves to a very few of theſe. A crop of rye-graſs and yellow clover ought to be ſpread as cut. A

day

day or two after, when the dew is evaporated, rake it into a number of parallel rows along the field, termed *wind-rows*, for the convenience of putting it up into ſmall cocks. After turning the rows once and again, make ſmall cocks weighing a ſtone or two. At the diſtance of two days or ſo, put two cocks into one, obſerving always to mix the tops and bottoms together, and to take a new place for each cock, that the leaſt damage poſſible may be done to the graſs. Proceed in putting two cocks into one, till ſufficiently dry for tramp-ricks of 100 ſtone each. The eaſieſt way of erecting tramp-ricks, is to found a rick in the middle of the row of cocks that are to compoſe it. The cocks may be carried to the rick by two perſons joining arms together. When all the cocks are thus carried to the rick within the diſtance of 40 yards or ſo, the reſt of the cocks will be more expeditiouſly carried to the rick, by a rope wound about them and dragged by a horſe. Two ropes are ſufficient to ſecure the ricks from wind the ſhort time they are to ſtand in the field. In the year 1775, 10,000 ſtone were put into tramp-ricks the fourth day after cutting. In a country ſo wet as many parts of Scotland are, expedition is of mighty conſequence in the drying both of hay and corn. With reſpect to hay intended for horned cattle, it is by the generality held an improvement, that it be heated a little in the ſtack; but ſome violently ſuſpect this doctrine to have been invented for excuſing indolent management. An ox, it is true, will eat ſuch hay; but it is uſually found that he prefers ſweet hay; and it cannot well be doubted, but that ſuch hay is the moſt ſalutary and the moſt nouriſhing.

Reaping and Storing up Corn and Hay.

The

Reaping and Storing up Corn and Hay.

Hay of red clover.

The making hay, conſiſting chiefly of red clover, requires more care. The ſeaſon of cutting is the laſt week of June, when it is in full bloom; earlier it may be cut, but never later. To cut it later would indeed produce a weightier crop; but a late firſt cutting makes the ſecond alſo late, perhaps too late for drying. At the ſame time, the want of weight in an early firſt cutting, is amply compenſated by the weight of the ſecond.

When the ſeaſon is too variable for making hay of the ſecond growth, mix ſtraw with that growth, which will be a ſubſtantial food for cattle during winter. This is commonly done by laying ſtrata of the ſtraw and clover alternately in the ſtack. But by this method, the ſtrata of clover, if they do not heat, turn mouldy at leaſt, and unpalatable. The better way is, to mix them carefully with the hand before they be put into the ſtack. The dry ſtraw imbibes moiſture from the clover and prevents heating.

Dr Anderſon's method.

But the beſt method of hay-making ſeems to be that recommended by Dr Anderſon *. "Inſtead (ſays he), of allowing the hay to lie, as uſual in moſt places, for ſome days in the ſwathe after it is cut, and afterwards alternately putting it up into cocks and ſpreading it out, and tedding it in the ſun, which tends greatly to bleach the hay, exhales its natural juices, and ſubjects it very much to the danger of getting rain, and thus runs a great riſk of being good for little, I make it a general rule, if poſſible, never to cut hay but when the graſs is quite dry; and then make the gatherers

* *Eſſays on Agriculture*, vol. i. p. 186.

gatherers follow cloſe upon the cutters, putting it up immediately into ſmall cocks about three feet high each when new put up, and of as ſmall a diameter as they can be made to ſtand with; always giving each of them a ſlight kind of thatching, by drawing a few handfuls of the hay from the bottom of the cock all around, and laying it lightly upon the top with one of the ends hanging downwards. This is done with the utmoſt eaſe and expedition; and when it is once in that ſtate, I conſider my hay as in a great meaſure out of danger: for unleſs a violent wind ſhould ariſe immediately after the cocks are put up, ſo as to overturn them, nothing elſe can hurt the hay; as I have often experienced, that no rain, however violent, ever penetrates into theſe cocks but for a very little way. And, if they are dry put up, they never ſit together ſo cloſely as to heat; although they acquire, in a day or two, ſuch a degree of firmneſs, as to be in no danger of being overturned by wind after that time, unleſs it blows a hurricane. Reaping and Storing up Corn and Hay.

"In theſe cocks I allow the hay to remain, until, upon inſpection, I judge that it will keep in pretty large tramp-cocks (which is uſually in one or two weeks, according as the weather is more or leſs favourable), when two men, each with a long pronged pitch-fork, lift up one of theſe ſmall cocks between them with the greateſt eaſe, and carry them one after another to the place where the tramp-cock is to be built *: and in this manner they proceed over the field till the whole is finiſhed.

"The

* If the hay is to be carried to any conſiderable diſtance, this part of the

Reaping and Storing up Corn and Hay.

Advantages of this method.

"The advantages that attend this method of making hay, are, that it greatly abridges the labour; as it does not require above the one-half of the work that is neceſſary in the old method of turning and tedding it: That it allows the hay to continue almoſt as green as when it is cut, and preſerves its natural juices in the greateſt perfection; for, unleſs it be the little that is expoſed to the ſun and air upon the ſurface of the cocks, which is no more bleached than every ſtraw of hay ſaved in the ordinary way, the whole is dried in the moſt ſlow and equal manner that could be deſired; and, laſtly, That it is thus in a great meaſure ſecured from almoſt the poſſibility of being damaged by rain. This laſt circumſtance deſerves to be much more attended to by the farmer than it uſually is at preſent; as I have ſeen few who are ſufficiently aware of the loſs that the quality of their hay ſuſtains by receiving a ſlight ſhower after it is cut, and before it is gathered; the generality of farmers ſeeming to be very well ſatisfied if they get in their hay without being abſolutely rotted, never paying the leaſt attention to its having been ſeveral times wetted while the hay was making. But if theſe gentlemen will take the trouble at any time to compare any parcel of hay that has been made perfectly dry, with another parcel from the ſame field that has received a ſhower while in the ſwathe, or even

a

---

the labour may be greatly abridged, by cauſing the carriers take two long ſticks of a ſufficient ſtrength, and having laid them down by the ſmall cocks parallel to one another, at the diſtance of one and a half, or two feet aſunder, let them lift three or four cocks, one after another and place them carefully above the ſticks, and then carry them altogether, as if upon a hand-barrow, to the place where the large rick is to be built.

a copious dew, they will ſoon be ſenſible of a very manifeſt difference between them; nor will their horſes or cattle ever commit a miſtake in chooſing between the two. Reaping and Storing up Corn and Hay.

"Let it be particularly remarked, that in this manner of making hay, great care muſt by taken that it be dry when firſt put into the cocks; for, if it is in the leaſt degree wet at that time, it will turn inſtantly mouldy, and ſit together ſo as to become totally impervious to the air, and will never afterwards become dry till it is ſpread out to the ſun. For this reaſon, if at any time during a courſe of good ſettled weather you ſhould begin to cut in the morning before the dew is off the graſs, keep back the gatherers till the dew is evaporated; allowing that which was firſt cut to lie till it is dry before it is cocked. In this caſe, you will almoſt always find that the uncut graſs will dry ſooner than that which has been cut when wet; and, therefore, the gatherers may always begin to put up that which is freſh cut before the other; which will uſually require two or three hours to dry after the new cut hay may be cocked. And if, at any time, in caſe of neceſſity, you ſhould be obliged to cut your hay before it is dry, the ſame rule muſt be obſerved, always to allow it to remain in the ſwathe till it is quite dry: but, as there is always a great riſk of being long in getting it up, and as it never in this caſe *wins* * ſo kindly as if it had been dry cut, the farmer ought to endeavour, if poſſible, in all caſes, to cut his hay only when dry; even if Particular caution requiſite in this method.

* By *winning* hay, is meant the operation by which it is brought from the ſucculent ſtate of graſs to that of a dry fodder.

Reaping and Storing up Corn and Hay.

if it ſhould coſt him ſome additional expence to the cutters, by keeping them employed at any other work, or even allowing them to remain idle if the weather ſhould be variable or rainy.

"But if there is a great proportion of clover, and the weather ſhould chance to be cloſe and calm at the time, it may, on ſome occaſions, be neceſſary to open up theſe cocks a little, to admit ſome freſh air into them; in which caſe, after they have ſtood a day or two, it may be of great uſe to turn theſe cocks and open them up a little, which ought to be done in the drieſt time of the day; the operator taking that part of each cock which was the top, and with it forming the baſe of a new one; ſo that the part which was moſt expoſed to the air becomes excluded from it, and that which was undermoſt comes to be placed upon the top, ſo as to make it all dry as equally as poſſible.

"If the hay has not been damp when it was firſt put up, the cock may be immediately finiſhed out at once; but if it is at all wet, it will be of great uſe to turn over only a little of the top of the cock at firſt, and leaving it in that ſtate to dry a little, proceed to another, and a third, and fourth, &c. treating each in the ſame way; going on in that manner till you find that the inſide of the firſt opened cock is ſufficiently dried, when it will be proper to return to it, turning over a little more of it till you come to what is ſtill damp, when you leave it and proceed to another, and ſo on round the whole; always returning afreſh till the cocks are entirely finiſhed. This is the beſt way of ſaving your hay, if you have been under the neceſſity of cutting it while damp; but it is always beſt to guard againſt this inconvenience, if poſſible."

We

We learn from the Annals of Agriculture*, that, in conſequence of the above ſuggeſtion by Dr Anderſon, the mode of making hay here recommended, was tried, with ſucceſs, by David Barclay, Eſq. "I hired three mowers at a guinea a week, with beer; and agreed with them to mow, as alſo to do any other kind of work, from five in the morning until eight in the evening; ſuch as trenching ground, clipping hedges, turning dunghills, &c. but not to mow until the graſs was perfectly free from moiſture, which was generally about nine o'clock in the morning: when they began, and after they had cut about half an acre, it appeared to be quite dry; three men were ſent to put it into cocks about three feet high; and they drew ſome of the longeſt of the graſs to lay upon the cock, by way of thatch, hanging downwards. When they had proceeded thus far on the firſt day, a ſmall ſhower of rain fell; and the mowers returned to their trenching which they were at in the morning; at four o'clock in the afternoon, the graſs being dry, they commenced cutting again till night, when the whole was left in cock; next morning about five o'clock a violent ſhower of rain fell, when my graſs was ſecured, whilſt that of my neighbours, which was tedded out, was thoroughly drenched: the afternoon was fair and windy, and all the cocks were opened, and made up again on freſh ground; and ſo I proceeded cutting, cocking, and opening the cocks, when the weather was quite fair; but, when the weather was doubtful, air was let into the cocks, by two men with pitching forks, raiſing them towards the wind; and, when I thought proper

Reaping and Storing up Corn and Hay.

Dr Anderſon's method tried.

* Vol. xxviii.

Reaping and Storing up Corn and Hay.

per to increaſe the ſize of the cocks, I was careful to do it in a fine day, and by this means I ſecured above 20 loads of good hay in three weeks; but, during the operation, two acres of my graſs got wet, before the men who followed the mowers could get into cock: I therefore determined to follow the uſual method with theſe two acres, by tedding and windrowing, which I had performed with as much care as poſſible; notwithſtanding which, the quality of the hay was not half the value of that made in the new way.

Reſult of the trial.

"Upon this proceſs I have to obſerve, that although it will take a longer time to effect the buſineſs, fewer hands are neceſſary than in the common mode; and I believe one-fourth of the uſual expence may be ſaved; but ſhould it appear, by repeated trials, that the new mode is a *certain* one to preſerve the crop of hay in wet weather, an increaſed length of time ſhould be diſpenſed with in a climate ſo ſubject to wet as this."

Courland method.

The following mode of make clover hay in wet weather, lately practiſed in Courland, is of ſo ſingular a nature, that we cannot paſs it over unnoticed, though we do not know, that it has yet been tried in this country. The account is extracted from the Tranſactions of the Society for the encouragement of Arts, Manufactures, and Commerce.—"In the method of making hay recommended by the Rev. Mr Klapmeyer, not only a number of hands are ſaved, but the hay is better and more nouriſhing. The hay is prepared by ſelf-fermentation, whereby it retains its nutritious juices, and only loſes its watery particles; it is dried more expeditiouſly by diſſipation of its humidity, and contraction of the ſap-veſſels, and thus its nutritious juices are concentrated. This proceſs is conducted in the following manner, viz.

The

The ſap-veſſels are expanded by the circulation of the liquid juices by heat, and the ſuperfluous humidity is exhaled: on cooling, the ſap-veſſels contract, and thus future inteſtine fermentation is prevented, and the nutritious quality preſerved. Reaping and Storing up Corn and Hay.

Upon this principle, the clover intended for hay, after having been mowed, remains till four o'clock in the afternoon of the following day in the ſwathe, to dry; it muſt then be raked together into ſmall coils, and afterwards made into large cocks, in the form of a ſugar-loaf, and ſuch as would require ſix or eight horſes to remove. To prevent the air from penetrating theſe cocks, and to produce a quicker fermentation, they muſt, whilſt forming, be trod down by one or two men. If it be a ſtill cloſe warm night, the fermentation will commence in four hours, and manifeſt itſelf by a ſtrong honey-like ſmell: when a proper fermentation is begun, the cocks will, on being opened, ſmoke, appear brownish, and may then be ſpread abroad. If in the morning the ſun is warm, and a little wind ariſes, the clover hay will quickly dry; it may then, towards noon, be turned with the rake or pitch-fork; and, about four in the afternoon, will be ſufficiently dry, ſo that it may be immediately carted into the barn, without any danger of a ſecond fermentation.

"By this method of management, the clover will require only three days from the time of mowing to its being houſed, and very little work; whilſt, in the common way, even in good weather, it requires ſix or eight days: in the old method, it frequently becomes of a black colour; but, in the new method, it is only brown, has an agreeable ſmell, and remains good and unchangeable in the barn. The farmer has alſo an-

Reaping and Storing up Corn and Hay.

other advantage, that, if he has not carts enough to carry it into the barn, he needs only at ſun-ſetting, to heap it again into large well-trodden cocks, and thatch them with ſtraw; in which ſtate they will remain the whole ſummer without damage or loſs. This clover hay is not only greedily eaten by ſheep and lambs, but alſo by horſes, calves, and cows.

"The laſt, in particular, prefer it to the beſt meadow hay; it produces a great quantity of rich milk; and the butter made from it is almoſt as yellow as ſummer butter.

"As this new mode of making hay depends principally upon two circumſtances,—firſt, that the mown clover, when brought together into large heaps, may ferment equally and expeditiouſly; ſecondly, that the day ſucceeding the fermentation be dry, ſunny, and windy—on this account it may be proper to point out what ſhould be done, when circumſtances are unfavourable.

"Let us ſuppoſe, therefore, that the night after the clover graſs has been placed in the great cocks, be cold, damp, or rainy, the fermentation will yet take place, although it may require a term of 12, 16, or 24 hours to effect it. If it be a ſecond or third crop, at which ſeaſon the nights are colder, it may even require from 36 to 48 hours before the fermentation enſues; it will, however, commence, and may be aſcertained from this circumſtance, that you can ſcarcely bear your hand in the interior of the cock.

"Even if the night be dry, yet if a cold ſtrong wind blows, the cock may not ferment equally, but only in the middle and on the ſide oppoſite to the wind, the other

other parts may ſtill remain green. In ſuch a caſe the following rules muſt be attended to:

Reaping and Storing up Corn and Hay.

"Firſt, If the cock has only fermented in the middle, and, on that ſide where the cold wind did not act upon it, the whole heap muſt, nevertheleſs, be opened the following morning. That which has already fermented, muſt be ſeparated and ſpread to dry; it muſt be turned towards noon, and may be carted into the barn in the evening; but that part of the cock, which has not fermented, muſt be again put together into large cocks, and fermented in the ſame manner as the preceding part; after which it may be ſpread to dry, and brought into the barn.

Rules for unfavourable caſes.

"Secondly, In ſuch caſes where a ſmall portion of the cock has fermented thoroughly, but not the greater part, the heap muſt be ſpread abroad in the morning, but muſt be again made into a cloſe cock in the evening, in ſuch a manner, that the part which has fermented be placed at the top or outſide of the cock, and that which has not fermented be incloſed within it; then, on the enſuing morning, or if the weather be cold and rainy on the morning afterwards, the clover heap may be again ſpread abroad, and the clover treated as in caſe firſt.

"Thirdly, If, in ſpreading the heap abroad, it be found that nearly the whole of the clover has fermented, it will not be neceſſary to delay the houſing of the whole, on account of ſome ſmall portion; but the clover may be dried and carted into the barn. The ſmall portion of clover, which remained unfermented, will not occaſion any diſaſter to the other which has fermented; for there is a material difference betwixt hay thus managed, and the meadow graſs which is brought,

Reaping and Storing up Corn and Hay.

whilſt damp or wet with rain, into the barn, which will grow muſty and putrid.

"Fourthly, In ſuch inſtances, where ſome of the cocks of clover have thoroughly fermented, and it rains on the morning, they ought to be ſpread abroad: for the clover muſt be opened and ſpread, even if it rains violently; ſince, if it was ſuffered to remain long in the heap, it would take fire, or its juices would be injured by too much fermentation, the leaves and ſtalks would become black and the clover unfit for food; therefore, if the rain continues, the ſpread clover muſt be turned from time to time, but not carted into the barn till dry. This drying takes place, if the rain diſcontinues for a few hours, much more expeditiouſly with the clover which has fermented, than with that made in the common way. Beſides which, it muſt be remarked, that the fermented clover remains good, even if it continues ſome weeks expoſed to the rain, provided it is at laſt ſuffered to dry before it is put into the barn, otherwiſe the wet from the rain will render it muſty and bad. The clover, which has been for ſo long a time expoſed to the rain, will not, however, be ſo nutritious as that which has been well fermented and ſooner dried; but it will be far ſuperior to that which has been expoſed to the rain, and got up in the common method.

"This new method has been adopted, with ſucceſs, during the years 1798 and 1799, in Sileſia, and found in every reſpect preferable to the old manner. On one of the eſtates there, it rained much during the haytime; they were obliged to ſpread the clover out of the large cocks, owing to its having fermented only in the middle: the parts which had not fermented were carefully

carefully ſeparated, and made again into large cocks, which fermented at the expiration of 36 hours, rainy weather and cold nights continuing during this period; after which time it was again ſpread abroad. The former, as well as the latter, remained for three days expoſed to the rain, during which period it was turned ſeveral times; the rain ceaſed on the fourth day, ſo that the clover hay was turned towards noon, and carted into the barn that evening. This clover hay remained in the hay-loft, without change, and was a very nutritious food. Several milch-cows were fed with it, who not only ate it greedily, but alſo increaſed in their milk. Lambs and calves alſo thrived with it greatly. This method of making clover hay prevents its taking fire; for clover, which has been once well fermented and dried, does not change or ſpoil in the hay-loft.

Reaping and Storing up Corn and Hay.

" If the weather ſhould be remarkably hot, you may, by adopting this plan, prevent a frequent accident; for graſs, haſtily made into hay, however dry it may appear to the hand, contains within its fibres much humidity; and, when trodden down in the ſtack, will ferment rapidly, from this humidity endeavouring to eſcape, which often fires the ſtack. A certain degree of fermentation is neceſſary in the making of hay, in order to develope its ſaccharine qualities, and make nutritious food. This ſaccharine fermentation is evident from the ſmell and colour of the hay in common ſtacks; and from taſting an infuſion of it. It reſembles, in ſome degree, the proceſs of making malt from barley, and requires a ſimilar attention. I have no doubt, that the method above related will prove generally advantageous in making clover, lucerne, and meadow hay,

Reaping and Storing up Corn and Hay.

in England, and lead to valuable improvements in agriculture."

Hay-ſtack.

In the yard, a ſtack of hay ought to be an oblong ſquare, if the quantity be greater than to be eaſily ſtowed in a round ſtack; becauſe a ſmaller ſurface is expoſed to the air than in a number of round ſtacks. For the ſame reaſon, a ſtack of peaſe ought to have the ſame form, the ſtraw being more valuable than that of oats, wheat, or barley. The moment a ſtack is finiſhed, it ought to be covered; becauſe the ſurface hay is much damaged by withering in dry weather, and moiſtening in wet weather. Let it have a pavilion-roof; for more of it can be covered with ſtraw in that ſhape, than when built perpendicular at the ends. Let it be roped as directed above for corn-ſtacks; with this difference only, that in an oblong ſquare the ropes muſt be thrown over the top, and tied to the belt-rope below. This belt-rope ought to be fixed with pins to the ſtack: the reaſon is, that the ropes thrown over the ſtack will bag by the ſinking of the ſtack, and may be drawn tight by lowering the belt-rope, and fixing it in its new poſition with the ſame pins.

The ſtems of hops, being long and tough, make excellent ropes; and it will be a ſaving article, to propagate a few plants of that kind for that very end.

A ſtack of rye-graſs hay, a year old, and of a moderate ſize, will weigh, each cubic yard, 11 Dutch ſtone. A ſtack of clover hay in the ſame circumſtances weighs ſomewhat leſs.

SECT.

SECT. VII.

MANURES.

THERE is no money laid out upon a farm, which pays ſo well, and which ſo very rarely diſappoints the farmer, as that which he expends for dung or other good manures.

Much has been written, and many ingenious hypotheſes preſented to the world, concerning thoſe ſubſtances which have been ſuppoſed to conſtitute the food of plants, and the modes of applying theſe ſubſtances to different ſoils, as a preparation for rearing abundant crops. We ſhall here, however, avoid entering into the conſideration of theſe ingenious and too refined diſcuſſions, and ſhall only remark, that the practical farmer, who wiſhes to advance ſafely and proſperouſly in his occupation, will probably find, that the beſt principle upon which he can proceed in forming his plans for the preparation of manure, will conſiſt of keeping ſtrictly in view the ideas which we formerly ſtated *, when conſidering the theory of agriculture. When we wiſh to fertilize land by art, we ought to follow nature, or to imitate the proceſs by which ſhe fertilizes it. Vegetable ſubſtances fermented by the putrefaction of animal matters, rapidly fall down into the earth, and aſſume the form of that rich black mould which is the moſt productive of all ſoils. The great object of the huſ-

Practical rule for forming manures.

* Vol. i. p. 115, 116.

Manures. bandman, therefore, ought to be to procure large quantities of vegetable ſubſtances of every kind, ſuch as ſtraw, ſtubble, ruſhes, weeds, &c. and to lay theſe up to ferment along with the freſh dung of animals, particularly thoſe animals which chew the cud, for by digesting their food in a very perfect manner, their dung contains a large portion of animal matter. As horſes, on the contrary, digeſt their food very weakly, their dung is often only ſufficiently animalized to bring on its own fermentation, which, however, is very ſtrong, on account of the large quantity of bits of ſtraw, hay, and other undecompoſed parts of their food, which it contains. In the neighbourhood of cities, other animal ſubſtances, beſides dung, may frequently be obtained; ſuch as bullocks blood, and the refuſe of works in which train oil is prepared, none of which ought to be neglected by the huſbandman.

The art of fermenting vegetable by animal matters, or the true art of making dung, has not yet been brought to perfection, nor is it in almoſt any ſituation ſufficiently attended to. In many places, we ſee large quantities of ferns, ruſhes, and the coarſe graſs of bogs, which no cattle will conſume, allowed to run to waſte; whereas, though theſe plants do not readily of themſelves run into fermentation, they might eaſily, by proper care, be made to undergo this proceſs, and conſequently be converted into a ſource of riches, that is, into fertile mould. On this ſubject, we ſhall here ſtate a mode of preparing dung upon the above principles, that has lately been diſcovered, and ſucceſsfully adopted in Mid Lothian by the Hon. Lord Meadowbank, one of the ſenators of the College of Juſtice in Scotland. It conſiſts of ſubjecting common peat-moſs to the proceſs of fermentation

mentation now mentioned, and has been explained by his lordſhip, in a ſmall printed pamphlet, of which, though not ſold to the public, a conſiderable number of copies have been diſtributed among his lordſhip's friends. It is in the following terms: "It is proper to ſtate in the outſet," ſays his lordſhip, "ſome general facts concerning the preparation of manure, which every practical farmer ſhould be acquainted with. Manures.

"1. All recently dead animal or vegetable matter, if ſufficiently divided, moiſt, and not chilled nearly to freezing, tends ſpontaneouſly to undergo changes, that bring it at length to be a fat greaſy earth, which, when mixed with ſands, clays, and a little chalk or pounded limeſtone, forms what is called rich loam, or garden-mould. Lord Meadowbank's mode of converting moſs into manure.

"2. In vegetable matter, when amaſſed in quantities, theſe changes are at firſt attended with very conſiderable heat, (ſometimes proceeding the length of inflammation), which, when not exceeding blood-heat, greatly favours and quickens the changes, both in animal matter, and the further changes in vegetable matter, that are not ſenſibly attended with the production of heat. The changes attended with heat, are ſaid to happen by a fermentation, named from what is obſerved in making of ale, wine, or vinegar. The latter are aſcribed to what is called *putrefactive fermentation*.

"3. Beſides moderate moiſture and heat, and that diviſion of parts which admits the air in a certain degree, circumſtances which ſeem to be neceſſary to the production of theſe changes, ſtirring, or mechanical mixture, favours them; and a ſimilar effect ariſes from the addition of chalk, pounded limeſtone, lime, rubbiſh

Manures. biſh of old buildings, or burnt lime brought back to its natural ſtate; and alſo of aſhes of burnt coal, peat, or wood, ſoap-leys, ſoot, ſea-ſhells, and ſea-ware. And, on the other hand, the changes are ſtopped or retarded by preſſure or conſolidation, excluding air; by much water, eſpecially when below the heat of a pool in ſummer; by aſtringents; and by cauſtic ſubſtances, as quicklime, acids, and pure alkalies, at leaſt till their cauſticity is mollified, at the expence of the deſtruction of part of the animal and vegetable matter to which they are added.

"4. Theſe changes are accompliſhed by the ſeparation or decompoſition of the parts or ingredients of which the dead vegetables and animals are compoſed; by the eſcape of ſomewhat of their ſubſtance in the form of vapours or gaſſes; by the imbibing alſo ſomewhat from water and from the atmoſphere; and by the formation of compound matters, from the reunion of parts or ingredients, which had been ſeparated by the powers of the living vegetables and animals. The earlier changes, and in general thoſe which take place previous to the deſtruction of the adheſion and texture of the dead vegetables and animals, appear to be rather pernicious than favourable to the growth of living vegetables, expoſed to the direct effect of them; whereas the changes ſubſequent to the deſtruction of the animal and vegetable texture promote powerfully the growth of plants, and, partly by their immediate efficacy on the plants expoſed to their influence, partly by the alterations they produce in the ſoil, conſtitute what is to be conſidered as enriching manure *.

"5. It

* Hot fermenting dung partakes of both ſorts of fermentation.

" 5. It ſhould be the object of the farmer to give his ſoil the full benefit of theſe latter changes, decompoſitions, and recompoſitions, which proceed ſlowly, and continue to go on for years after the manure is lodged in the ſoil. Even loam or garden-mould is ſtill undergoing ſome remaining changes of the ſame ſort; and, by frequently ſtirring it, or removing it, and uſing it as a top-dreſſing, its ſpontaneous changes are ſo favoured, that it will yield heavy crops for a time, without freſh manure; or, in other words, it is rendered in ſo far a manure itſelf, as it decompoſes faſter than in its ordinary and more ſtationary ſtate, and, in ſo doing, nouriſhes vegetables more abundantly, or forms new combinations in the adjoining ſoil, that enable it to do ſo. Manures.

" It ſhould alſo be the object of the farmer, to employ the more early changes, not only to bring forward the ſubſtances undergoing them into a proper ſtate to be committed to the ſoil, but to accelerate or retard them, ſo as to have his manure ready for uſe at the proper ſeaſons, with as little loſs as poſſible, from part being too much and part too little decompoſed; and alſo to avail himſelf of the activity of thoſe changes, to reſtore to a ſtate of ſufficiently rapid ſpontaneous decompoſition, ſuch ſubſtances in his farm, as, though in a ſtate of decay, had become ſo ſtationary, as to be unfit for manure, without the aid of heat and mixture.

" By attention to the two firſt particulars, and the proper uſe of compreſſion, ſtirring, and mixture, the farm dunghill, though formed ſlowly and of materials in very various ſtates of decay, is brought forward in nearly the ſame condition. By attention to the latter,

manure

Manures. manure may, in moſt ſituations in Scotland, be tripled or quadrupled; *et ſimum eſt aurum.* On the other hand, by inattention to them, part of the manure is put into the ſoil unprepared, that is, in a ſituation where the texture of the vegetable is ſtill entire; and, its decompoſition never having been carried far by the heat and mixture of a fermenting maſs, proceeds in the ſoil ſo ſlowly, that, like ploughed-down ſtubble, it does not merit the name of manure. Part, again, is apt to be too much rotted, that is, much of it is too nearly approaching to the ſtate of garden-mould, whereby much benefit is loſt, by the eſcape of what had been ſeparated during the proceſs it has undergone, and the good effects on the ſoil of what remains are leſs durable; for, between ſolution in water, and rapid decompoſition from its advanced ſtate of rottenneſs, it is ſoon reduced to that of garden-mould; and, in fine, the powers of fermenting vegetable with animal matter, which, when properly employed, are certainly moſt efficacious in converting into manure many ſubſtances that are otherwiſe very ſtationary and ſlow in their decompoſition, are loſt to the farmer, ſo that he is often reduced to adopt an imperfect and little profitable mode of cultivation, from the want of the manure requiſite for a better, though ſuch manure may be lying in abundance within his reach, but uſeleſs from his ignorance how to prepare it.

" *Peat-moſs* is to be found in conſiderable quantities within reach of moſt farms in Scotland, particularly in thoſe diſtricts where outfield land (i. e. land not brought into a regular courſe of cropping and manuring) forms the larger part of the arable land. It conſiſts of the remains of ſhrubs, trees, heath, and other vegetables,

vegetables, which, under the influence of a cold and moiſt climate, and in wet ſituations, have got into a condition almoſt ſtationary, but much removed from that of the recently dead vegetable, and certainly conſiderably diſtant from that of garden-mould. It is no longer ſuſceptible of going of itſelf, though placed in the moſt favourable circumſtances, into that rapid fermentation, accompanied with heat, which maſſes of freſh vegetables experience: But it is ſtill a powerful fuel when dried; and, on the other hand, it requires long expoſure to the ſeaſons, in a dry ſituation, before, without mixture, it is fit for the nouriſhing of living vegetables. Manures.

"In general, however, there is nothing in the ſituation of peat-moſs, or in the changes it has undergone, that leads to think that it has ſuffered any thing that unfits it to be prepared for manure. It is no doubt found ſometimes mixed with particular mineral ſubſtances, that may be, for a time, pernicious to vegetation; but, in general, there is no ſuch admixture, and, when it does take place, a little patience and attention will be ſufficient to cure the evil. In the ordinary caſe, the only ſubſtances found in peat that may be unfavourable to vegetation, in ſo far at leaſt as tending to keep it ſtationary and prevent its rotting, are two, and both abounding in freſh vegetables of the ſorts of which moſs is chiefly compoſed: Theſe are, gallic acid, and the aſtringent principle or tan; and as theſe are got the better of in freſh vegetables by the hot fermentation to which they are ſubject, ſo as to leave the general maſs of the ſubſtances to which they belonged properly prepared manure, there is no reaſon to ſuppoſe, that the ſame may not be accompliſhed with the

Manures. the acid and tan of peat Again, the powers of peat as a fuel, and of aſhes of peat as a manure, ought to convince every perſon, that the material and more eſſential parts of the dead vegetable, for the formation of manure, remain entire in peat. Here the inflammable oils and carbonaceous matter which abound in the freſh vegetable, and the latter of which alſo abounds in garden-mould, remain entire; the ſoot and aſhes, too, which are the reſults of the inflammation of each, ſeem to be nearly equally fertilizing; and, in ſhort, little ſeems to be loſt in peat but the effects of the firſt fermentation in preparing the matter to undergo its future changes with the rapidity requiſite to conſtitute manure. Beſides, the ſoil produced from peat-earth, by expoſure for a courſe of years, ſeems not to be ſenſibly different from that obtained from dung in the ſame way. Both are deficient in firmneſs of texture; but are very proliſic when mixed with clays, ſand, and calcareous earths, in due proportion.

" From conſidering the preceding circumſtances, and from trying what ſubſtances operated on tan, and on the acid found in peat-moſs, it was determined to ſubject it to the influence of different ſorts of fermenting dung, with due attention to the proportions uſed, and to the effects of the different preparations; and the following is the direction, which an experience of ſix crops recommends to practice.

" Let the peat-moſs of which compoſt is to be formed, be thrown out of the pit for ſome weeks or months, in order to loſe its redundant moiſture. By this means, it is rendered the lighter to carry, and leſs compact and weighty, when made up with freſh dung, for fermentation; and accordingly leſs dung is required for the pur-

poſe

poſe, than if the preparation is made with peat taken recently from the pit. Manures.

"Take the peat-moſs to a dry ſpot, convenient for conſtructing a dunghill, to ſerve the field to be manured. Lay it in two rows, and dung in a row betwixt them: the dung thus lies on the area of the compoſt-dunghill, and the rows of peat ſhould be near enough each other, that workmen, in making up the compoſt, may be able to throw them together by the ſpade, without wheeling. In making up, let the workmen begin at one end. Lay a bottom of peat, ſix inches deep, and 15 feet wide, if the ground admit of it *. Then lay about 10 inches of dung above the peat; then about ſix inches of peat; then four or five of dung, and then ſix more of peat; then another thin layer of dung; and then cover it over with peats at the end where it was begun, at the two ſides, and above. It ſhould not be raiſed above four feet, or four and a half feet high, otherwiſe it is apt to preſs too heavily on the under part, and check the fermentation. When a beginning is thus made, the workmen will proceed working backwards, and adding to the column of compoſt, as they are furniſhed with the three rows of materials, directed to be laid down for them. They muſt take care not to tread on the compoſt, or render it too compact; and of conſequence, in proportion as the peat is wet, it ſhould be made up in lumps, and not much broken.

"In mild weather, ſeven cart-loads of common farm-dung, tolerably freſh made, is ſufficient for 21 cart-loads

* This alludes to the propriety, in clay lands, of ſuiting the dunghill to the breadth of a ſingle *ridge*, free of each furrow.

Manures. loads of peat-moſs; but in cold weather, a larger proportion of dung is deſirable. To every 28 carts of the compoſt, when made up, it is of uſe to throw on above it a cart-load of aſhes, either made from coal, peat, or wood; or if theſe cannot be had, half the quantity of ſlaked lime may be uſed, the more finely powdered the better. But theſe additions are nowiſe eſſential to the general ſucceſs of the compoſt.

"The dung to be uſed ſhould either have been recently made, or kept freſh by compreſſion; as, by the treading of cattle or ſwine, or by carts paſſing over it. And if there is little or no litter in it, a ſmaller quantity will ſerve, provided any ſpongy vegetable matter is added at making up the compoſt, as freſh weeds, the rubbiſh of a ſtack-yard, potato-ſhaws, ſawings of timber, &c. And as ſome ſorts of dung, even when freſh, are much more advanced in decompoſition than others, it is material to attend to this; for a much leſs proportion of ſuch dung, as is leſs advanced, will ſerve for the compoſt, provided care is taken to keep the maſs ſufficiently open, either by a mixture of the above-mentioned ſubſtances, or, if theſe are wanting, by adding the moſs piece-meal, that is, firſt mixing it up in the uſual proportion of three to one of dung, and then, after a time, adding an equal quantity, more or leſs, of moſs. The dung of this character, of greateſt quantity, is ſhamble-dung, with which, under the above precautions, ſix times the quantity of moſs, or more, may be prepared. The ſame holds as to pigeon-dung, and other fowl-dung; and to a certain extent, alſo, as to that which is collected from towns, and made by animals that feed on grains, refuſe of diſtilleries, &c.

"The

" The compoſt, after it is made up, gets into a gene- Manures.
ral heat, ſooner or later, according to the weather and the condition of the dung: in ſummer, in ten days or ſooner; in winter, not perhaps for many weeks, if the cold is ſevere. It always, however, has been found to come on at laſt; and in ſummer, it ſometimes riſes ſo high, as to be miſchievous, by conſuming the materials, (fire-faning). In that ſeaſon, a ſtick ſhould be kept in it in different parts, to pull out and feel now and then: for if it approaches to blood-heat, it ſhould either be watered, or turned over; and on ſuch an occaſion, advantage may be taken to mix it with a little freſh moſs. The heat ſubſides after a time, and with great variety, according to the weather, the dung, and the perfection of the making up of the compoſt; which then ſhould be allowed to remain untouched, till within three weeks of uſing, when it ſhould be turned over, upſide down, and outſide in, and all lumps broken: then it comes into a ſecond heat; but ſoon cools, and ſhould be taken out for uſe. In this ſtate, the whole, except bits of the old decayed wood, appears a black free maſs, and ſpreads like garden-mould. Uſe it, weight for weight, as farm-yard dung; and it will be found, in a courſe of cropping, fully to ſtand the compariſon.

" The addition recommended of aſhes or lime, is thought to favour the general perfection of the preparation, and to haſten the ſecond heat. The lime laid on above the dunghill, as directed, is rendered mild by the vapours that eſcape during the firſt heat.

" Compoſt, made up before January, has hitherto been in good order for the ſpring-crops; but this may not happen in a long froſt. In ſummer, it is ready in

Manures.

eight or ten weeks; and if there is an anxiety to have it ſoon prepared, the addition of aſhes, or of a little lime-rubbiſh of old buildings, or of lime, ſlaked with foul water, applied to the dung uſed in making up, will quicken the proceſs conſiderably.

" Lime has been mixed previouſly with the peat; but the compoſt prepared with that mixture, or with the ſimple peat, ſeemed to produce equally good crops. All the land, however, that it has been tried on, has been limed more or leſs, within theſe 25 years.

" Peat prepared with lime alone, has not been found to anſwer as a good manure. In one inſtance, viz. on a bit of fallow ſown with wheat, it was manifeſtly pernicious. Neither with cow-water alone is it prepared, unleſs by lying immerſed in a pool of it for a long time, when it turns into a ſort of fleetch, which makes an excellent top-dreſſing. Something of the ſame ſort happens with ſoap-ſuds, and water of common ſewers, &c. Lime-water was not found to unite with the tan in peat, nor was urine *. Peat made up with ſea-weed gets into heat, and the peat ſeems to undergo the ſame change as when prepared with dung. But the effect of this preparation on crops has not yet been experienced. Peat has alſo been expoſed to the fumes of

* Tan combines with animal gelly, and loſes its aſtringency. The animalized matter, extricated in fermenting dung, has probably this effect on the tan in peat, as well as to render the acid innocent. As vegetable matters ſeem in general to contain the ingredients of, and are often ſomewhat ſimilar to, animal gluten, it is poſſible that the fermentation of freſh vegetables alone may prove ſufficient to prepare the peat to rot in the ſoil expeditiouſly; but it is certainly deſirable to uſe alſo animalized matter for this purpoſe.

of a putrefying carcaſe. In one inſtance the peat proved a manure; but much weaker than when prepared with dung. There, however, the proportion uſed was very large to the carcaſe. Other trials are making, where the proportion is leſs, and with, or without, the addition of aſhes, lime, &c. In all theſe caſes, there can be no ſenſible heat. Peat, heated and rendered friable by the action of the living principle of turnips in growing, was not found entitled, when uſed as top-dreſſing, to the character of manure. It had been made up in the view of preſerving the turnips during froſt. But the turnips ſprung, and the maſs heated. The turnips were taken out, and the peat afterwards uſed as a top dreſſing. Peat is now under trial, as preparing with turnips and freſh weeds, in fermentation, without the admixture of any animalized matters. Manures.

"It is ſaid that dry peat-earth is uſed as a manure in ſome parts in England. But unleſs in chalky ſoils, or others where there may be a great want of carbonaceous matter, it is much doubted whether it could be uſed with any ſenſible advantage. Peat-aſhes were found to raiſe turnips, but to have no ſenſible effect on the next crop.

"The quantity of the compoſt uſed per acre has varied, conſiderably, acording to the richneſs of the ſoil manured, and the condition in which it is at manuring, and the ſeaſon in which the manure is applied. From 23 to 35 cart load, by two horſes each, is about what has been given; the leſſer to fallows and ground in good tilth, and the larger when to be ploughed in with the ſward of poor land; and the intermediate quantities, with tares, peas, potatoes, &c.; and it has in moſt

Manures. caſes undergone comparative trials with different ſorts of common dung.

"It may be proper to add, that too much attention cannot be paid to the proper preparation of the ground for the reception of manure. It ſhould be clean, pretty dry at the application, and well mixed and friable. Much of the manure applied is otherwiſe loſt, whether lime, dung, or compoſt. The additional quantities recommended when the land is coarſe, is juſt ſo much that would have been ſaved by better cultivation. Common farmers are little aware of this. They might ſave at leaſt half their lime, did they lay it on in powder *, and on fallows, only harrowing it, and letting it wait for a ſhower before it is ploughed in; and perhaps not much leſs of their dung. It is aſtoniſhing what a viſible effect is produced on land properly mixed by a fallow, from the addition of only a very ſmall quantity of properly prepared dung or compoſt. Both its texture and colour undergo a very ſenſible change, which cannot be accounted for, except from the extrication of ſubſtances from the decompoſing manure, (probably from its ſpontaneous tendency to decompoſe being aided by the chemical action of various matters in a ſoil ſo prepared): And from theſe ſubſtances operating in the ſoil, numberleſs compoſitions and decompoſitions, or tendencies to them, take place, from the various elective attractions of the different parts of which it is compoſed. It is obvious, that an immenſe-

ly

* This they may, though driven in winter, and drowned in heaps by rains. They have only to turn it over with a very ſmall additional quantity of new burnt ſhells when they come to uſe it

ly greater proportion of manure muſt be required to produce even a little of this, where the ſoil is coarſe or lumpy, or conſolidated by wetneſs, than when put into a ſituation favourable to the reciprocal action of the various ſubſtances contained in it, a variety and an admixture formed by nature in perfection in the more favoured ſoils, (as in the bottom of drained lakes, haughs, Delta ground), and which it is the buſineſs of the ſkilful and induſtrious farmer to form, or make compenſation for the want of, by judicious manuring, where nature has been leſs bountiful of her gifts. Manures.

" It was meant to have given a detailed account of many of the experiments that have been made, whether in agriculture or chemiſtry. But as theſe are ſtill going on, and the practical reſults have attracted ſome attention, and prompted imitation by neighbours and acquaintance, ſo that manuſcript directions have been often applied for and obtained; it has been preferred to print, in the mean time, this ſhort account of the buſineſs, diveſted of ſcientific language, and ſuited to the peruſal of any practical huſbandman. It was indeed felt as a degree of wrong, not to take ſome ſteps to make it public as ſoon as the certainty of ſucceſs warranted. And both the power and the duration of the manure have now ſtood the teſt of a great variety of trials, on a conſiderable extent of ground, and of much diverſity of ſoil, continued without intermiſſion during the laſt ſix years. Hitherto it has been found equal, and indeed preferable, to common farm-yard dung, for the firſt three years, and decidedly to ſurpaſs it afterwards. It has been conjectured, from the appearance and effects of the compoſt, that its parts are leſs volatile and ſoluble than thoſe of

Manures. dung; but that it yields to the crop what is requiſite, by the action of the living fibres of vegetables; and in this way waſtes flower, and laſts longer. Whatever be in this, nothing has appeared more remarkable, than its ſuperiority in maintaining (for four and five years) freſh and nouriſhing, the paſture of thin clays, that had been laid down with it, and in making them yield well when again ploughed, and that without any top-dreſſing, or new manure of any ſort. Employed in this way, the effect of common dung is ſoon over, the ſoil becoming conſolidated, and the paſture ſtunted; and hence ſuch ſoils have not uſually been cultivated with advantage, except by tillage, and by the aid of quantities of manure, got by purchaſe, and much beyond the produce of the farm-yard. It is believed that the foregoing directions will, if practiſed, prove beneficial to every farmer who has acceſs to peat-moſs, within a moderate diſtance; but it is to the farmers of the ſoil now mentioned, and of hungry gravels, to whom they would be found particularly valuable.

" Let it be obſerved, that the object in making up the compoſt is to form as large a hot-bed as the quantity of dung employed admits of, and then to ſurround it on all ſides, ſo as to have the whole benefit of the heat and effluvia. Peat, as dry as garden-mould, in ſeed-time, may be mixed with the dung, ſo as to double the volume and more, and nearly triple the weight, and inſtead of hurting the heat prolong it. Workmen muſt begin with uſing layers; but, when accuſtomed to the juſt proportions, if they are furniſhed with peat moderately dry, and dung not loſt in litter, they throw it up together as a mixed maſs; and they improve in the art,

ſo

ſo as to make a leſs proportion of dung ſerve for the preparation." Manures.

With regard to the other kinds of manure commonly in uſe in this country, their efficacy is well known; the only difficulty is to procure them in ſufficient quantity. In ſuch lands as lie near the ſea, ſea-weeds offer an unlimited quantity of excellent manure. In the neighbourhood of rivers, the weeds with which they abound offer likewiſe an excellent manure in plenty. Oil-cake, malt-coombs, the refuſe of ſlaughter-houſes, &c. all are excellent where they can be got: but the ſituations which afford theſe are comparatively few; ſo that in moſt caſes the farmer muſt depend much on his own ingenuity and induſtry for raiſing a ſufficient quantity of dung to anſwer his purpoſes; and the methods taken for this purpoſe vary according to the ſituation of different places, or according to the fancy of the huſbandman. Of the more common kinds of manure.

At a diſtance from towns the farmer muſt evidently depend for his beſt manure upon the numbers of cattle he keeps, and the mode in which he manages their dung in making it up into farm-yard compoſt. His firſt rule ought to be, to ſell from his farm as little as poſſible of the hay or ſtraw, but rather to conſume them in making manure. It is only by doing ſo that he can poſſibly expect to ſee his lands in a train of conſtant improvement. For the management of the farm-yard the following, among other rules, are laid down in vol. xxiii. of the Annals of Agriculture. "At the moſt leiſure ſeaſon before the time of confining his cattle to fodder, ſo much marl, turf, dry mud, loam, &c. ſhould be carted into the farm-yard, as will cover the whole about 12 inches deep; and if there are many Rules for producing farm-yard dung.

Manures. ſtables, hog-houſes, bullock or cow-ſtalls, that are cleaned into it, to ſpread ſuch earth thicker in thoſe places. Thoſe who have the fortunate opportunity of uſing bog-peat from the vicinity of a bog or boggy bottom ſhould not neglect it; ſuch ſtuff is a vegetable dunghill.

" Before he begins to fodder, which will be probably ſome time in November, let him litter the whole yard well with either ſtubble, fern, or leaves. For this purpoſe, I ſuppoſe all his wheat ſtubbles mown, chopped, or hochled (as it is termed in ſome counties), and ſtacked in or very near the yards. If he is near a warren, heath, or common, he may probably be able to procure fern cheap; that is, at the price of eight or ten ſhillings a waggon load, in bulk equal to a ton and a half of dry hay; wherever ſuch opportunities exiſt, they ought never to be neglected.

Litter of Stubble.

" If his neighbours will ſell their ſtubble at 12s. to 15s. a waggon-load delivered in, he ought to provide a large quantity.

Fern. " Fern, in burning, yields more alkaline ſalts than any other vegetable, which is proof ſufficient how valuable the dung muſt be; but care muſt be taken to rot it well, which is more difficult than to rot ſtraw.

" No money which a farmer can expend is better laid out than in the purchaſe of litter of any kind; for his cattle do not only lie dry, warm, and bedded, but the quantity of manure he raiſes is very large, and cheaper than in any other way of buying it.

Leaves. " The other article I named, *leaves*, depends on his ſituation. If he is in a woodland, where the trees are thick and ſpreading, they are to be raked into heaps, and

and carted to the farm-yard, at a very moderate expence; they make excellent litter, and very good dung. If he has any marſhes in his neighbourhood that afford a good ſwarth of ruſhes, coarſe graſs, flags, &c. he ſhould not neglect to lay in good ſtore of theſe for the ſame uſe; and if he has the power of cutting the aquatics that riſe under water in lakes or meres, or flooded ground, he may do it by jointed ſcythes, and rake them into boats. Manures. Ruſhes, &c.

"Theſe ſteps being taken, the farmer is well prepared to meet the winter, and to turn it greatly to his advantage; but, in order to this, he muſt adopt that huſbandry which this climate points out as neceſſary; but which thoſe commonly eſteemed more happy are exempted from, and conſequently tempt farmers to neglect this neceſſary buſineſs of making dung. The management I mean is the ſtrict confinement of his cattle during winter. Some curious cattle maſters tie them up in ſtalls: I do not require it; but it is eſſential that they are confined to the yard, and on no account ſuffered to roam about any paſtures, which is a practice too common. If all the cattle of a farm are abſolutely confined to the yard, the lean ſtock to ſtraw, and the reſt to ſtraw and turnips, &c. or to hay, the compoſt of marl, litter, and waſte ſtraw, will have the neceſſary quantity of animal manure amongſt it to ferment, rot, and turn to rich manure; whereas, if the cattle do not live entirely in the farm-yard, the heap may be large, but of little value. Confinement of cattle in winter.

"The common error to be ſeen in the management of half the yards in the kingdom is ſuffering the drainings to run to waſte. Rain and ſnow will, in ſpite of any management, ſometimes overflow; but, in general, Yard-drainings.

the

Manures. the whole may be under command. The beſt method is to ſink a well about five feet deep in the loweſt corner of the yard, to fix a pump in it, and to raiſe a ſmall ſtage whereon to ſtand and to work it; a trough will then convey the water to a large heap of marl, chalk, turf, loam, &c.; and daily pumping over it, will make it of little leſs value than a heap of dung of the ſame ſize. The whole expence of what is neceſſary for this will be under four pounds; and that of pumping is too trifling to think of. The dung ſhould never be ſuffered to remain under water, however rich it may be, as putrefaction is in that caſe ſtopped.

Dung not to be much ſtirred.

"Many perſons turn over their dunghills frequently, in order that they may rot the ſooner; but I have often obſerved, that no dung becomes ſo thoroughly and equally converted into a mucilaginous maſs, into black butter, as the farmers call it, as that which never was ſtirred at all. By moving the dung is made to lie looſe and hollow; every freſh fermentation that is excited in that ſtate volatilizes the oil and alkaline ſalt, and carries it off to the atmoſphere. Hence we ſee, that a dunghill often ſtirred or moved, though black and rotten, is by far drier than one which has remained untouched; and it is the fat oily wet rottenneſs that is valuable, that is mucilaginous. The longer you keep, and the oftener you mix your dung, the drier it becomes, till at laſt it has the appearance of black ſnuff, and might be ſown by hand. Hence, therefore, to avoid too much ſtirring and moving (which, by the way, is very expenſive alſo), I would let it reſt in the farmyard till the land is ready it is deſigned for, and fodder in another yard. If the buildings and conveniences will not allow this, then in the ſpring, as ſoon as the

foddering

foddering is over, I would, inſtead of turning over, cart it at once out of the yard into a heap, taking care to mix the marl with the litter as well as poſſible in filling the carts, and making the heap in the field where it is to be uſed, leaving it untouched; in which way the dung has but one ſtirring alſo. The heap ſhould not be above four feet thick, and not carted upon; and if it is put in a ſhady place, under thick ſpreading trees, ſo much the better." Manures.

The common folding of ſheep is well known in many parts of the kingdom; but the covered fold is nowhere general in Britain. In various parts of Europe, however, it is regularly done, and among the Romans it was common huſbandry. "The method I would recommend (ſays the above writer), is to open ſome out-houſe adjoining the farm-yard; or build a ſlight ſhed in any convenient part of the farm, incloſed with a high pale, in ſuch a manner that the ſheep may either be under cover, or expoſed to the weather, as they pleaſed; that is, to have an apartment ſheltered, and a ſmall area before it incloſed. The whole to be covered with marl, turf, or loam, 12 inches deep, and then well littered regularly through the winter with whatever litter the farmer has in plenty. The advantage of this practice is very great; a few ſheep cannot be folded in the common manner with any profit; for the expence and trouble of conſtantly moving the hurdles will overbalance it; but in the ſtanding fold, the caſe is different; a ſcore of ſheep will in a winter make a dunghill that is a real object. The value of the dung raiſed thus, is much greater than any one can ſuppoſe that has not tried it. Ewes and their lambs in cold driving rain and ſnow, lie ſheltered and warm, and do much Covered ſheep-fold.

Manures. much better than when expoſed to ſuch weather, eſpecially if you give them hay in racks, which ſhould be always practiſed in ſuch ſtanding folds.

"It is ſaid, that in Flanders, where this huſbandry is practiſed, they ſtrew their houſes with ſand inſtead of litter."

Crops ploughed in. The "ſyſtem of manuring by means of green vegetables (this writer adds), has many advocates, and there have been inſtances of its being attended with great ſucceſs. It conſiſts in ploughing in a full crop of ſome ſucculent vegetable, ſuch as clover, buckwheat or tares. To make them turn in well, two circumſtances are neceſſary; they muſt have a barley roller run over them, a trench-plough muſt follow, going the ſame way as the roller did. A common plough will do it very incompletely, for they are not entirely buried; if the points ſtick out between the furrows, they will not die, and conſequently not ferment: but Mr Ducket's trench-plough buries completely. This work ſhould always be done in ſummer, or very early in autumn, while the ſun has power to forward the fermentation, for in winter little or no uſe would reſult from the practice. The benefit will depend on circumſtances; but chiefly, I ſhould apprehend, on the diſpoſition of the ſoil to promote and forward the putrefactive fermentation. If the maſs of vegetables is ſpeedily converted by putrefaction into mucilage, there can be no doubt but you acquire manure. And this will depend on the weather: if a very cold, or cold and wet ſeaſon followed, the whole perhaps might be nearly loſt; but if the weather is moderately moiſt and very warm, the fermentation will be ſpeedy. Nothing leſs than a very great crop ſhould be ploughed in; a large maſs putrefies in a quite different

ferent manner from a ſmall one: a thin crop might not putrefy at all, that is, in union with the land. A degree of putrefaction enſues wherever any animal dungs, but the ſoil is very little better for it; but turn in ſo much dung, that the incumbent earth and the dung ſhall together feel an excited fermentation, the benefit will be great. But after all, that queſtion yet remains, whether a great crop of clover, buck-wheat, and tares, mown green, for ſoiling in the farm, will not, in the conſumption by cattle yield more and better manure than can reſult from ploughing them in. I muſt own, in my opinion, they might." Manures.

This writer very ſenſibly adds, that "the young farmer ſhould be ſenſible of the importance of all animal ſubſtances, which are greatly preferable to all vegetable manures, many kinds being procurable in great cities; curriers ſhavings, woollen rags, hogs hair, feathers, offals of butchers and fiſhmongers ſtalls and kennels, trotters, horn ſhavings, &c. It ſhould be received as a maxim, that all animal ſubſtances whatever make admirable manures, much better than any thing in the vegetable or foſſil kingdoms; and this ſhould not only direct him in the purchaſe of his manures; but alſo to be very attentive in preventing any ſuch ſubſtances in his own houſe and farm being waſted: the compoſt dunghill ſhould be the general receptacle of all ſuch. I muſt, however, obſerve, that ſome of theſe ſubſtances are ſold at ſuch high prices, that common dung is a better purchaſe. Compoſt of fiſh is excellent." Animal manures

In Norfolk, Mr Marſhal tells us, that the *quality* of dung is attended to with greater preciſion than in moſt other diſtricts. *Town-muck*, as it is called, is held in moſt eſtimation; and the large towns, Norwich In Norfolk, what dung valued.

Manures. wich and Yarmouth, ſupply the neighbouring country. As Yarmouth, however, is a maritime place, and otherwiſe in a manner ſurrounded by marſhes, ſtraw is of courſe a ſcarce and dear article; whence, inſtead of littering their horſes with it, they uſe ſand. As the bed becomes ſoiled or wet, freſh ſand is put on, until the whole is in a manner ſaturated with urine and dung, when it is cleared away, and reckoned muck of ſuch excellent quality, that it is ſent for from a very great diſtance. With regard to other kinds of dung, that from horſes fed from hay and corn is looked upon to be the beſt; that of fatting cattle the next; while the dung of lean cattle, particularly of cows, is ſuppoſed to be greatly inferior, even though turnips make part of their food. The dung of cattle kept on ſtraw alone is looked upon to be of little or no value; while the muck from trodden ſtraw is by ſome thought to be better than that from the ſtraw which is eaten by the lean ſtock.—Compoſts of dung with earth or marl are very generally uſed.

In the midland diſtrict. In the midland counties of England, Mr Marſhal informs us, the cores of horns cruſhed in a mill have been uſed as manure; though he knows not with what ſucceſs. His only objection is the difficulty of reducing them to powder. Dung is extremely dear in Norfolk; half a guinea being commonly given for a waggon-load driven by five horſes. Great quantities of lime and marl are found in this diſtrict. With regard to the method of raiſing dung in general, perhaps the obſervations of Mr Marſhal upon the management of the Yorkſhire farmers may be attended to in addition to what has been already ſtated.

"The

"The general practice (ſays he) is to pile the dung on the higheſt part of the yard; or, which is ſtill leſs judicious, to let it lie ſcattered about on the ſide of a ſlope, as it were for the purpoſe of diſſipating its virtues. The urine which does not mix with the dung is always invariably led off the neareſt way to the common ſewer, as if it were thought a nuiſance to the premiſes. That which mixes with the dung is of courſe carried to the *midden*, and aſſiſts in the general diſſipation. A yard of *dung*, nine-tenths of which are ſtraw, will diſcharge, even in dry weather, ſome of its more fluid particles; and in rainy weather, is, notwithſtanding the ſtraw, liable to be waſhed away if expoſed on a riſing ground. But how much more liable to waſte is a mixture of dung and urine, with barely a ſufficiency of ſtraw to keep them together? In dry weather the natural oozing is conſiderable; and in a wet ſeaſon every ſhower of rain waſhes it away in quantities. The Norfolk method of bottoming the dung-yard with mould is here indiſpenſably neceſſary to common good management. There is no better manure for graſs-lands than mould ſaturated with the oozing of a dunghill: it gets down quickly among the graſs, and has generally a more viſible effect than the dung itſelf. Under this management the arable land would have the ſelf-ſame dung it now has; while the graſs-land would have an annual ſupply of riches, which now run to waſte in the ſewers and rivulets. But before a dung-yard can with propriety be bottomed with mould, the bottom of the yard itſelf ought to be properly formed. A part of it, ſituated conveniently for carriages to come at, and low enough to receive the entire drainings of the ſtable, cattle-ſtalls, and hog-ſties, ſhould be hol-

Manures.

Mr Marſhall's directions for raiſing dung.

lowed

Manures. lowed out in the manner of an artificial drinking-pool, with a rim ſomewhat riſing, and with covered drains laid into it from the various ſources of liquid manure. During the ſummer months, at leiſure times, and embracing opportunities of back-carriage, fill the hollow nearly full with mould, ſuch as the ſcourings of ditches, the ſhovellings of roads, the maiden earth of lanes and waſte corners, the coping of ſtone-quarries, &c. &c. leaving the ſurface ſomewhat diſhed; and within this diſh ſet the dung-pile, carefully keeping up a rim of mould round the baſe of the pile higher than the adjoining ſurface of the yard; equally to prevent extraneous matter from finding its way into the reſervoirs, and to prevent the eſcape of that which falls within its circuit."

Of lime as a manure. The uſe of lime, as a manure, was formerly mentioned*, and alſo the principle upon which its value depends. It ought to be uſed not for the purpoſe of giving food to the plants, but as a ſtimulant, tending to bring the ſoil into activity, by reducing to mould all the dead roots of vegetables with which it may abound. Hence it ought never to be uſed without dung upon ſoils that have been exhauſted by repeated cropping, and that are in a clean ſtate.

Its operation. However people may differ in other particulars, all agree, that the operation of lime depends on its intimate mixture with the ſoil; and therefore that the proper time of applying it, is when it is perfectly powdered, and the ſoil at the ſame time in the higheſt degree of pulverization. Lime of itſelf is abſolutely barren; and

* Vol. i. p. 122, &c.

and yet it enriches a barren ſoil. Neither of the two produces any good effect without the other; and conſequently, the more intimately they are mixed, the effect muſt be the greater. Manures.

Hence it follows, that lime ought always to be ſlaked with a proper quantity of water, becauſe by that means it is reduced the moſt effectually into powder. Lime left to be ſlaked by a moiſt air, or accidental rain, is ſeldom or never thoroughly reduced into powder, and therefore can never be intimately mixed with the ſoil. Sometimes an opportunity offers to bring home ſhell-lime before the ground is ready for it; and it is commonly thrown into a heap without cover, truſting to rain for ſlaking. The proper way is, to lay the ſhell-lime in different heaps on the ground where it is to be ſpread, to reduce theſe heaps into powder by ſlaking with water, and to cover the ſlaked lime with ſod, ſo as to defend it from rain. One, however, ſhould avoid as much as poſſible the bringing home lime before the ground be ready for it. Where allowed to lie long in a heap, there are two bad conſequences: firſt, lime attracts moiſture, even though well covered, and runs into clots, which prevents an intimate mixture; and, next, we know that burnt limeſtone, whether in ſhells or in powder, returns gradually into its original ſtate of limeſtone both chemically and mechanically, for it loſes its cauſtic quality, and becomes ſo hard bound together as to require a pick to ſeparate the parts.

For the ſame reaſon, it is a bad practice, though common, to let ſpread lime lie on the ſurface all winter. The bad effects above mentioned take place here in part: and there is another, that rain waſhes the

Manures. lime down to the furrows, and in a hanging field carries the whole away.

Time of liming. As the particles of powdered lime are both ſmall and heavy, they quickly ſink to the bottom of the furrow, if care be not taken to prevent it. In that view, it is a rule, that lime be ſpread and mixed with the ſoil immediately before ſowing, or along with the ſeed. In this manner of application, there being no occaſion to move it till the ground be ſtirred for a new crop, it has time to incorporate with the ſoil, and does not readily ſeparate from it. Thus, if turnip-ſeed is to be ſown broad-caſt, the lime ought to be laid on immediately before ſowing, and harrowed in with the ſeed. If a crop of drilled turnip or cabbage be intended, the lime ought to be ſpread immediately before forming in drills. With reſpect to wheat, the lime ought to be ſpread immediately before ſeed-furrowing. If ſpread more early, before the ground be ſufficiently broken, it ſinks to the bottom. If a light ſoil be prepared for barley, the lime ought to be ſpread after ſeed-furrowing, and harrowed in with the ſeed. In a ſtrong ſoil, it ſinks not ſo readily to the bottom, and therefore, before ſowing the barley, the lime ought to be mixed with the ſoil by a brake. Where moor is ſummer-fallowed for a crop of oats next year, the lime ought to be laid on immediately before the laſt ploughing, and braked in as before. It has ſufficient time to incorporate with the ſoil before the land be ſtirred again.

Quantity. The quantity to be laid on depends on the nature of the ſoil. Upon a ſtrong ſoil, 70 or 80 bolls of ſhells are not more than ſufficient, reckoning four ſmall firlots to the boll, termed *wheat meaſure*, nor will it be an over-doſe

overdoſe to lay on 100 bolls. Between 50 and 60 may ſuffice upon medium ſoils; and upon the thin or gravelly, between 30 and 40. It is not ſafe to lay a much greater quantity on ſuch ſoils. Manures.

It is common to lime a paſture-field immediately before ploughing. This is an unſafe practice; it is thrown to the bottom of the furrow, from which it is never fully gathered up. The proper time for liming a paſture-field, intended to be taken up for corn, is a year at leaſt, or two, before ploughing. It is waſhed in by rain among the roots of the plants, and has time to incorporate with the ſoil. Liming paſture-fields.

Limeſtone beat ſmall makes an excellent manure; and ſupplies the want of powdered lime where there is no fuel to burn the limeſtone. Limeſtone beat ſmall has not hitherto been much uſed as a manure; and the proportion between it and powdered lime has not been aſcertained. What follows may give ſome light. Three pounds of raw lime are by burning reduced to about two pounds of ſhell-lime. Yet nothing is expelled by the fire but the air that was in the limeſtone: the calcareous earth remains entire. *Ergo*, two pounds of ſhell-lime contain as much calcareous earth as three pounds of raw limeſtone. Shell-lime of the beſt quality, when ſlaked with water, will meaſure out to thrice the quantity. But as limeſtone loſes none of its bulk by being burnt into ſhells, it follows, that three buſhels of raw limeſtone contain as much calcareous earth as ſix buſhels of powdered lime; and conſequently, if powdered lime poſſeſs not ſome virtue above raw limeſtone, three buſhels of the latter beat ſmall ſhould equal as a manure ſix buſhels of the former. Beat limeſtone.

The goodneſs of marl, as a manure, depends on Marl.

Manures. the quantity of calcareous earth in it: which has been known to amount to a half or more. It is too expenſive if the quantity be leſs than a third or a fourth part. Good marl is the moſt ſubſtantial of all manures; becauſe it improves the weakeſt ground to equal the beſt borough-acres. The low part of Berwickſhire, termed *the Merſe*, abounds everywhere with this marl; and is the only county in Scotland where it is plenty.

Land ought to be cleared of weeds before marling; and it ought to be ſmoothed with the brake and harrow, in order that the marl may be equally ſpread. Marl is a foſſil on which no vegetable will grow; its efficacy depends, like that of lime, on its pulverization, and intimate mixture with the ſoil. Towards the former, alternate drought and moiſture contribute greatly, as alſo froſt. Therefore, after being evenly ſpread, it ought to lie on the ſurface all winter. In the month of October it may be rouſed with a brake; which will bring to the ſurface, and expoſe to the air and froſt, all the hard parts, and mix with the ſoil all that is powdered. In that reſpect it differs widely from dung and lime, which ought uſually to be ploughed into the ground without delay. Oats are a hardy grain, which will anſwer for the firſt crop after marling better than any other; and they will ſucceed though the marl be not thoroughly mixed with the ſoil. In that caſe, the marl ought to be ploughed in with an ebb furrow immediately before ſowing, and braked thoroughly. It is tickliſh to make wheat the firſt crop: if ſown before winter, froſt ſwells the marl, and is apt to throw the ſeed out of the ground; if ſown in ſpring, it will ſuffer more than oats by want of due mixture.

Summer

Summer is the proper ſeaſon for marling; becauſe in that ſeaſon the marl, being dry, is not only lighter, but is eaſily reduced to powder. Froſt, however, is not improper for marling, eſpecially as in froſt there is little opportunity for any other work. Manures.

Marl is a heavy body, and ſinks to the bottom of the furrow, if indiſcreetly ploughed. Therefore it is generally underſtood, that the firſt crop ſhould always have an ebb furrow. During the growing of that crop, the marl has time to incorporate with the ſoil, and to become a part of it; after which it does not readily ſeparate.

Of late a new manure has been introduced into ſome countries. This is gypſum, which is lime united with ſulphuric acid. In the eighth volume of the Annals of Agriculture we are informed, that it is commonly uſed as a manure in Switzerland. In the 10th volume of the ſame work, Sir Richard Sutton gives ſome account of an experiment made with it on his eſtate; but in ſuch an inaccurate manner, that nothing could be determined. "The appearance in general (ſays he), I think, was rather againſt the benefit of the plaſter, though not decidedly ſo." He tells us, that its virtues were a ſubject of debate in Germany. In America this ſubſtance ſeems to have met with more ſucceſs than in any other country. In the fifth volume of the Bath Papers, Mr Kirkpatrick of the Iſle of Wight, who had himſelf viſited North America, informs us, that it is much uſed in the United States, on account of its cheapneſs and efficacy; though, from what is there ſtated, we muſt undoubtedly be led to ſuppoſe, that its *efficacy* muſt be very great before it can be entitled to the praiſe of *cheapneſs*. In the firſt place, it is brought from the hills Of gypſum as a manure.

Manures. in the neighbourhood of Paris to Havre de Grace, and from thence exported to America; which of itſelf muſt occaſion a conſiderable expence, though the plaſter were originally given *gratis*. In the next place, it muſt be powdered in a ſtamping mill, and the finer it is powdered ſo much the better. In the third place, it muſt be *ſown* over the ground to be manured with it. The quantity for graſs is ſix buſhels to an acre. It ought to be ſown on dry ground in a wet day; and its efficacy is ſaid to laſt from ſeven to twelve years. It operates entirely as a top-dreſſing.

In the 10th volume of the Annals of Agriculture, we have ſome extracts from a treatiſe by Mr Powel, preſident of the Philadelphia Society for encouraging Agriculture, upon the ſubject of gypſum as a manure; of the efficacy of which he gives the following inſtances: 1. In October 1786, plaſter of Paris was ſown in a rainy day upon wheat-ſtubble without any previous culture. The crop of wheat had ſcarce been worth reaping, and no kind of graſs ſeed had been ſown upon the ground; nevertheleſs, in the month of June it was covered with a thick mat of white clover, clean and even, from ſix to eight inches in height. A piece of ground adjoining to this white clover was alſo ſown with gypſum, and exhibited a fine appearance of white and red clover mixed with ſpear-graſs. Some wet ground ſown at the ſame time was not in the leaſt improved.—This anecdote reſts entirely on the veracity of an anonymous farmer. 2. Eight buſhels of plaſter of Paris ſpread upon two acres and a half of wheat-ſtubble ground, which the ſpring before had been ſowed with about two pounds of red clover-ſeed to the acre for paſture, yielded five tons of hay by the middle of

July.

June. A ſmall piece of ground of ſimiliar quality, but without any plaſter, produced only one ton and a half in the ſame proportion.—Mr Powel concludes in favour of the effects of the plaſter upon arable as well as graſsland. Manures.

Other accounts to the ſame purpoſe have been publiſhed; though it muſt alſo be remarked, that various perſons who have made trial of this manure, declare themſelves diſſatisfied with it; but it does not appear that it has hitherto been at all tried in this part of the iſland.

We are informed in the 12th volume of the Annals of Agriculture, that in Cornwall, large quantities of ſea-ſand are annually conveyed to the land, and laid upon the ſoil; a practice which will no doubt have a tendency to ameliorate ſtiff clays, and to render them more pervious to the roots of plants. With the ſame view, and alſo to ſave fuel, a practice is ſaid to exiſt in the Netherlands, of baking up the droſs or culm of coal, and alſo peat-earth, with clay, into lumps or bricks, which when dried in the air, make excellent fuel, and alſo afford an immenſe quantity of valuable aſhes to be laid upon the land. Sea-ſand as a manure.

We cannot quit this ſubject of manures, without taking notice of an eſſay upon it by the celebrated chemiſt and mineraliſt Richard Kirwan, Eſq. He remarks, that the only ſubſtances common to growing vegetables, and to the ſoils on which they grow, are water, coal, different earths, and ſalts; and that theſe, therefore, muſt be the true food of vegetables. He obſerves, that graſſes and corn abſorb and perſpire during the time of their growth about one half their weight of water each day, if the weather be favourable. "With Kirwan on manures. Food of plants.

Manures. Coal.

regard to coal, it not only forms the *reſiduum* of all vegetable ſubſtances that have undergone a ſlow and ſmothered combuſtion, that is, to which the free acceſs of air has been prevented, but alſo of all putrid vegetable and animal bodies. Hence it is found in vegetable and animal manures, and is the true baſis of their ameliorating powers. If the water that paſſes through a putrefied dunghill be examined, it will be found of a brown colour, and if ſubjected to evaporation, the principal part of the reſiduum will be found to conſiſt of coal. All ſoils ſteeped in water communicate the ſame colour to it in proportion to their fertility; and this water being evaporated, leaves alſo a coal, as Mr Haſſenfratz and Fourcroy atteſt. They alſo obſerved, that ſhavings of wood being left in a moiſt place for nine or ten months, began to receive the fermentative motion; and being then ſpread on land, putrefied after ſome time, and proved an excellent manure. Coal, however, cannot produce its beneficial effects but in as much as it is ſoluble in water. The means of rendering it ſoluble are not as yet well aſcertained; nevertheleſs it is even now uſed as a manure, and with good effect. In truth, the fertilizing power of putrid animal and vegetable ſubſtances was fully known, even in the remoteſt ages; but moſt ſpeculiſts have hitherto attributed them to the oleaginous, mucilaginous, or ſaline particles then developed, forgetting that land is fertilized by *paring* and *burning*, though the oleaginous and mucilaginous particles are thereby conſumed or reduced to a coal; and that the quality of mucilage, oil, or ſalt, in fertile land is ſo ſmall that it could not contribute the thouſandth part of the weight of any vegetable; whereas coal is ſupplied not only by the land, but alſo by the fixed air

combined

combined with the earth, and alſo by that which is conſtantly ſet looſe by various proceſſes, and ſoon precipitates by the ſuperiority of its ſpecific gravity, and is then condenſed in or mechanically abſorbed by ſoils, or contained in dew. Lands, which contain iron in a ſemicalcined ſtate, are thereby enabled to decompoſe fixed air; the iron, by the help of water, gradually attracting the pure air which enters into the compoſition of fixed air, as Mr Gadolin has ſhown; a diſcovery which appears to me among the moſt important of theſe later times; but theſe calces of iron may again be reſtored to their former ſtate by union with oleaginous ſubſtances, as Mr Beaume has noticed; and this is one of the benefits reſulting from the application of dung before it has fully putrefied. Hence we may underſtand how ſoils become effete and exhauſted; this effect ariſing, in great meaſure, from the gradual loſs of the carbonic principle depoſited by vegetable and animal manures, and from their paſſing into the growing vegetables; and alſo from the loſs of the fixed air contained in the argillaceous part of the ſoil which is decompoſed by vegetables, and from the calcination of the ferruginous particles contained in the ſoil." Manures.

Concerning earths, Mr Kirwan obſerves, that minute portions of theſe are found in trees, and ſomewhat larger portions in culmiferous plants, into which they can only enter when diſſolved or ſuſpended in water. Minute portions of ſalts are alſo found in vegetables. On the whole, with regard to manuring or fertilizing a ſoil, Mr Kirwan conſiders the great queſtion to be "how to render charcoal ſoluble in water for the purpoſes of vegetation." And to diſcover that compoſition of the different earths, beſt ſuited to detain or exhale the due Earths and ſalts.

proportion

Manures. proportion of the average quantity of moiſture that falls in each particular country."

Upon the firſt of theſe points Mr Kirwan ſuggeſts nothing very particular. He obſerves, that dung is a proper ingredient in the improvement of all ſorts of ſoils; apprehending, no doubt, that its fermentation is the beſt mode yet diſcovered of rendering charcoal ſoluble in water for the purpoſe of vegetation. He is chiefly anxious about pointing out the proper kinds of earths or mixtures of earths which ought to be applied to particular ſoils for their amelioration. With this view he explains minutely the way in which chemiſts may analyze the conſtituent parts of a ſoil. He remarks, that "the beſt manure for clayey ſoils is marl: in this all the books of agriculture are unanimous, and of the different ſorts of marl, that which is moſt calcareous is beſt; the ſiliceous next beſt; limeſtone gravel beſt of all; and argillaceous marl leaſt advantageous."

Mixtures of earths to improve a ſoil.

Mixtures for clay ſoils.

"Clayey ſoils are defective both in conſtitution and in texture: they want the calcareous ingredient and coarſe ſand. Calcareous marl ſupplies the calcareous ingredient chiefly; limeſtone gravel both. The other marls ſupply them in a leſſer degree.

"A mixture of marl and dung is ſtill more advantageous, becauſe the dung ſupplies the carbonaceous ingredient. But the marl muſt be uſed in the ſame quantity as if dung had not been applied, otherwiſe the operation muſt be more frequently repeated.

"If marl cannot be had, a mixture of coarſe ſand and lime perfectly effete or extinguiſhed, or chalk, will anſwer the ſame purpoſe, as it will ſupply the defective ingredient, and open the texture of the clay.

So alſo ſand alone, or chalk, or powdered limeſtone, may anſwer, though leſs advantageouſly. Lime alone appears to me leſs proper, as it is apt to cake, and does not ſufficiently open the ſoil. Manures.

" When theſe manures cannot be had, coal-aſhes, chips of wood, burnt clay, brick-duſt, gravel, or even pebbles, are uſeful; for all theſe improve the texture, and the former ſupply alſo the carbonaceous ingredient."

A ſoil conſiſting of clayey loam " is defective either in the calcareous ingredient, or in the ſandy, or in both; if in the firſt, the proper manure is chalk; if in the ſecond, ſand; if in both, ſiliceous marl or limeſtone gravel, or effete lime and ſand."

The chalky ſoil " wants both the argillaceous and the ſtony, ſandy, or gravelly, ingredients; therefore the beſt manure for it is clayey loam or ſandy loam; but when the chalk is ſo hard, as it frequently is in England, and ſo difficultly reducible to impalpable powder, as to keep of itſelf the ſoil ſufficiently open, then clay is the beſt manure, as in ſuch caſes the coarſe ſand or gravelly ingredients of loam are of no uſe. Some think, it is true, that pebbles in a field ſerve to preſerve or communicate heat; this uſe, however, is not ſufficiently aſcertained. Mixtures for a chalky ſoil.

" The beſt manure for *chalky-loam* is clay, or argillaceous marl if clay cannot be had, becauſe this ſoil is defective principally in the argillaceous ingredient.

" For ſandy ſoils the proper manure is calcareous marl. " In Norfolk they ſeem to value clay more than marl, probably becauſe their ſandy ſoils already contain calcareous parts; poſſibly alſo they miſname marl, calling mere chalk by that name. Lime or Mixtures for ſandy ſoils.

chalk

Manures. chalk are leſs proper, as they do not give ſufficient coherence to the ſoil; however, when mixed with earth or dung, they anſwer well, becauſe they form a ſort of marl or compound, comprehending the defective ingredients.

"For ſandy loams, chalk is recommended to be followed by clay; for till or vitriolic ſoils, lime or limeſtone gravel, or calcareous marl; for bogs or boggy ſoils, paring and burning, or lime are approved of; for heathy ſoils the ſame remedies are recommended. Gypſum is alſo conſidered as anſwering well for heathy ſoils when dry. Mr Kirwan obſerves, that the principal advantages ariſing from paring and burning are two: "Firſt, that it converts vegetables and their roots into coal. Hence it is, that agricultural writers tell us, though without knowing the reaſon, that all violence of fire is to be avoided, and that a ſlow ſmothering fire is beſt.

Theoretical advantage of paring and burning.

"Secondly, that it deſtroys the old ſickly roots; and thus leaves room for others younger and more vigorous. But unleſs freſh ſeeds be ſown, the ſoil will be unproductive for a number of years, and the coaly principle is apt to be raſhly exhauſted by an unſkilful huſbandman taking repeated white crops in ſucceſſion."

SECT.

Drill Huſbandry.

SECT. VIII.

PRINCIPLES AND OPERATIONS OF THE DRILL OR HORSE-HOEING HUSBANDRY.

THE general properties attributed to the hoeing or drill huſbandry may be reduced to two, viz. the promoting the growth of plants by hoeing, and the ſaving of ſeed; both of which are equally profitable to the farmer.

Advantages aſcribed to horſe-hoeing.

The advantages of tillage before ſowing have already been pointed out. In this place we muſt confine ourſelves to the utility of tillage after ſowing. This kind of tillage is moſt generally known by the name of *horſe-hoeing*.

Land ſowed with wheat, however well it may be cultivated in autumn, ſinks in the winter; the particles get nearer together, and the weeds riſe; ſo that in ſpring, the land is nearly in the ſame ſituation as if it never had been ploughed. This, however, is the ſeaſon when it ſhould branch and grow with moſt vigour, and conſequently ſtands moſt in need of ploughing or hoeing, to deſtroy the weeds, to ſupply the roots with freſh earth, and, by dividing anew the particles of the ſoil, to allow the roots to extend and collect nouriſhment.

It is well known, that, in gardens, plants grow with double vigour after being hoed or tranſplanted. If plants growing in arable land could be managed with

eaſe

Drill Huſbandry.

eaſe and ſafety in this manner, it is natural to expect, that their growth would be promoted accordingly. Experience ſhows, that this is not only practicable, but ſometimes attended with many advantages.

In the operation of hoeing wheat, though ſome of the roots be moved or broken, the plants receive no injury; for this very circumſtance makes them ſend forth a greater number of roots than formerly, which enlarge their paſture, and conſequently augment their growth.

Sickly wheat has often recovered its vigour after a good hoeing, eſpecially when performed in weather not very hot or dry.

Wheat, and ſuch grain as is ſown before winter, requires hoeing more than oats, barley, or other grain ſown in the ſpring; for, if the land has been well ploughed before the ſowing of ſpring corn, it neither has time to harden, nor to produce many weeds, not having been expoſed to the winter's ſnow and rain.

Of Sowing.

Method of ſowing in the drill huſbandry.

As in the practice of this new huſbandry, plants grow with greater vigour than by the old method, the land ſhould be ſowed thinner. It is this principle of the hoeing huſbandry that has been chiefly objected to; for, upon obſerving the land occupied by a ſmall number of plants, people are apt to look upon all the vacant ſpace as loſt. But this prejudice will ſoon be removed, when it is conſidered, that in the beſt land cultivated in the common method, and ſown very thick, each ſeed produces but one or two ears; that, in the ſame land ſown thinner, every ſeed produces two or three

ears;

ears; and that a ſingle ſeed ſometimes produces 18 or 20 ears. Drill Huſbandry.

In the common method, as there are many more plants than can find ſufficient nouriſhment, and as it is impoſſible to aſſiſt them by hoeing, numbers die before they attain maturity; the greateſt part remain ſickly and drooping; and thus part of the ſeed is loſt. On the contrary, in the new method, all the plants have as much food as they require; and as they are, from time to time, aſſiſted by hoeing, they become ſo vigorous as to equal in their production the numerous but ſickly plants cultivated in the common method.

Of Hoeing.

The new huſbandry is abſolutely impracticable in lands that are not eaſily ploughed. Attempting to cultivate land according to this huſbandry, without attending to this circumſtance, that it is practicable in no land excepting ſuch as has already been brought into good tilth by the old method, has gone far to make it contemptible in many places.

When a field is in good tilth, it ſhould be ſown ſo thin as to leave ſufficient room for the plants to extend their roots. After being well ploughed and harrowed, it muſt be divided into rows, at the diſtance of thirty inches from one another. On the ſides of each of theſe rows, two rows of wheat muſt be ſowed ſix inches diſtant from each other. By theſe means there will be an interval of two feet wide betwixt the rows, and every plant will have room enough to extend its roots, and to ſupply it with food. The intervals will likewiſe be ſufficient for allowing the earth to be hoed or tilled without injuring the plants in the rows.

The

Drill Husbandry.

The different hoeings.

The firſt hoeing, which ſhould be given before the winter, is intended to drain away the wet, and to diſpoſe the earth to be mellowed by the froſts. Theſe two ends will be anſwered by drawing two ſmall furrows at a little diſtance from the rows, and throwing the earth taken from the furrows into the middle of the intervals. This firſt hoeing ſhould be given when the wheat is in leaf.

The ſecond hoeing, which is intended to make the plants branch, ſhould be given after the hard froſts are over. To do this with advantage, after ſtirring the earth a little near the rows, the earth which was thrown into the middle of the intervals ſhould be turned back into the furrows. This earth, having been mellowed by the winter, ſupplies the plants with excellent food, and makes the roots extend.

The third hoeing, which is intended to invigorate the ſtalk, ſhould be given when the ears of the corn begin to ſhow themſelves. This hoeing may, however, be very ſlight.

But the laſt hoeing is of the greateſt importance, as it enlarges the grain, and makes the ears fill at their extremities. This hoeing ſhould be given when the wheat is in bloom; a furrow muſt be drawn in the middle of the interval, and the earth thrown to the right and left on the foot of the plants. This ſupports the plants, prevents them from being laid, and prepares the ground for the next ſowing, as the ſeed is then to be put in the middle of the ground that formed the intervals.

The beſt ſeaſon for hoeing is two or three days after rain, or ſo ſoon after rain as the ſoil will quit the inſtrument in hoeing. Light dry ſoils may be hoed al-

moſt at any time, but this is far from being the caſe with ſtrong clay ſoils; the ſeaſon for hoeing ſuch is frequently ſhort and precarious; every opportunity therefore ſhould be carefully watched, and eagerly embraced. The two extremes of wet and dry, are great enemies to vegetation in ſtrong clay ſoils. There is a period between the time of clay ſoils running together, ſo as to puddle by ſuperfluous wet, and the time of their caking by drought, in which they are perfectly manageable. This is the juncture for hoeing; and ſo much land as ſhall be thus ſeaſonably hoed, will not cake or cruſt upon the ſurface, as it otherwiſe would have done, till it has been ſoaked or drenched again with rain; in which caſe the hoeing is to be repeated as ſoon as the ſoil will quit the inſtrument, and as often as neceſſary; by which time the growing crop will begin to cover the ground, ſo as to act as a ſcreen to the ſurface of the land againſt the intenſe heat of the ſun, and thereby prevent, in a great meaſure, the bad effects of the ſoil's caking in dry weather. Drill Huſbandry.

By this ſucceſſive tillage, or hoeing, good crops will be obtained, provided the weather is not very unfavourable.

But as ſtrong vigorous plants are long before they arrive at maturity, corn raiſed in the new way is later in ripening than any other, and muſt therefore be ſown earlier.

In order to prepare the intervals for ſowing again, ſome well-rotted dung may be laid in the deep furrows made in the middle of the intervals; and this dung muſt be covered with the earth that was before thrown towards the rows of wheat. But, if the land does not require mending, the deep furrow is filled without any

Drill Husbandry.

dung. This operation ſhould be performed immediately after harveſt, that there may be time to give the land a ſlight ſtirring before the rows are ſowed; which ſhould occupy the middle of the ſpace which formed the intervals during the laſt crop. The intervals of the ſecond year take up the ſpace occupied by the ſtubble of the firſt.

Suppoſing dung to be neceſſary, which is denied by many, a very ſmall quantity is ſufficient; a ſingle layer, put in the bottom of each furrow, will be enough.

Deſcription of the Inſtruments commonly uſed in the New Huſbandry.

Inſtruments deſcribed Plate X.

Fig. 3. is a marking plough. The principal uſe of this plough is to ſtraight and regulate the ridges. The firſt line is traced by the eye, by means of three poles,

Marking plough.

placed in a ſtraight line. The plough draws the firſt furrow in the direction of this line; and at the ſame time, with the tooth A, fixed in the block of wood near the end of the croſs-pole or ſlider BB, marks the breadth of the ridge at the diſtance intended. The ploughman next traces the ſecond line or rutt made by the tooth, and draws a ſmall furrow along it; and continues in this manner till the whole field is laid out in ſtraight and equidiſtant ridges.

Breaking-up plough

Fig. 4. is a plough for breaking up ley, or turning up the bottom of land when greatly exhauſted. By its conſtruction, the width and depth of the furrows can be regulated to a greater certainty than by any other hitherto known in this country. Its appearance is heavy: but two horſes are ſufficient to plough with it in ordinary free land; and only four are neceſſary in the

the ſtiffeſt clay-ſoils. This plough is likewiſe eaſily held and tempered. A, is the ſword fixed in the ſizers B, which runs through a mortiſe E, at the end of the beam C, and regulates the depth of the furrow by raiſing or depreſſing the beam; it is fixed by putting the pin D through the beam and ſword, and is moveable at E. Drill Huſbandry.

Fig. 1. is a jointed brake-harrow with 24 teeth, ſhaped like coulters, and ſtanding at about an angle of 80 degrees. By this inſtrument the land is finely pulverized, and prepared for receiving the ſeed from the drill. It requires four horſes in ſtiff, and two in open land. This harrow is likewiſe uſed for levelling the ridges; which is done by preſſing it down by the handles where the ridge is high, and raiſing it up when low. Plate X. Jointed harrow.

Fig. 2. is an angular weeding harrow, which may follow the brake when neceſſary. The ſeven hindmoſt teeth ſhould ſtand at a more acute angle than the reſt, in order to collect the weeds, which the holder can drop at pleaſure, by raiſing the hinder part, which is fixed to the body of the harrow by two joints. Weeding harrow.

Fig. 3. is a pair of harrows with ſhafts. This harrow is uſed for covering the ſeed in the drills, the horſe going in the furrow. Harrow with ſhafts.

Fig. 1. is a drill-plough, conſtructed in ſuch a manner as to ſow at once two rows of beans, peaſe, or wheat. This machine is eaſily wrought by two horſes. A, is the happer for containing the ſeed; B, circular boxes for receiving the ſeed from the happer; CC, two ſquare boxes which receive the ſeed from ſmall holes in the circular boxes, as they turn round; and laſt of all, Plate VII. Drill-plough.

Drill Husbandry.

the ſeed is dropped into the drills through holes in the ſquare boxes, behind the coulters D. The cylinder E follows, which, together with the wheel F, regulates the depth of the coulters, and covers the ſeed; the harrow G comes behind all, and covers the ſeed more completely. HH, two ſliders, which, when drawn out, prevent the ſeed from falling into the boxes; and, I, is a ketch which holds the rungs, and prevents the boxes from turning, and loſing ſeed at the ends of the ridges.

Plate X. Single hoe-plough.

Fig. 4. is a ſingle hoe-plough of a very ſimple conſtruction, by which the earth in the intervals is ſtirred and laid up on both ſides to the roots of the plants, and at the ſame time the weeds are deſtroyed. AA the mouldboards, which may be raiſed or depreſſed at pleaſure, according as the farmer wants to throw the earth higher or lower upon the roots.

Plate V. Drill-rake.

Fig. 2. is a drill-rake for peaſe. This inſtrument, which is chiefly calcul ted for ſmall incloſures of light grounds, is a ſort of ſtrong plough-rake, with four large teeth at *a*, *a*, *b*, *b*, a little incurvated. The diſtance from *a* to *a*, and from *b* to *b*, is nine inches. The interval between the two inner teeth, *a* and *b*, is three feet ſix inches, which allows ſufficient room for the hoe-plough to move in. To the piece of timber *c c*, forming the head of the rake, are fixed the handles *d*, and the beam *e* to which the horſe is faſtened. When this inſtrument is drawn over a piece of land made thoroughly fine, and the man who holds it bears upon the handles, four furrows, *f*, *g*, *h*, *i*, will be formed, at the diſtance determined by the conſtruction of the inſtrument. Theſe diſtances may be accurately preſerved, provided that the teeth *a a* return when the plough-

man

man comes back, after having ploughed one turn, in two of the channels formed before, marked *b b*: thus all the furrows in the field will be traced with the ſame regularity. When the ground is thus formed into drills, the peaſe may be ſcattered by a ſingle motion of the hand at a certain diſtance from one another into the channels, and then covered with the flat part of a hand-rake, and preſſed down gently. This inſtrument is ſo ſimple, that any workman may eaſily make or repair it. Drill Huſbandry.

On Plate XIII. fig. 1. is delineated a patent drill machine, ſome time ago invented by the Reverend James Cooke of Heaton-Nouris near Mancheſter. A, the upper part of the ſeed-box. B, the lower part of the ſame box. C, a moveable partition, with a lever, to which the grain or ſeed is let fall at pleaſure from the upper to the lower part of the ſeed-box, from whence it is taken up by cups or ladles applied to the cylinder D, and dropped into the funnel E, and conveyed thereby into the furrow or drill made in the land by the coulter F, and covered by the rake or harrow G. H, a lever, by which the wheel I is lifted out of generation with the wheel K, to prevent the grain or ſeed being ſcattered upon the ground, while the machine is turning round at the end of the land, by which the harrow G is alſo lifted from the ground at the ſame time, and by the ſame motion, by means of the crank, and the horizontal lever *b*, *b*. L, a ſliding lever, with a weight upon it, by means of which the depth of the furrows or drills, and conſequently the depth that the grain or ſeed will be depoſited in the land, may be eaſily aſcertained. M, a ſcrew in the coulter beam, by turning of which the ſeed-box B Cooke's drill-machine.

Drill Husbandry.

is elevated or depreſſed, in order to prevent the grain or ſeed being cruſhed or bruiſed by the revolution of the cups or ladles. Fig. 2. a rake with iron teeth, to be applied to the under ſide of the rails of the machine, with ſtaples and ſcrew-nuts at *n n*, by which many uſeful purpoſes are anſwered, viz. in accumulating cuitch or hay into rows, and as a ſcarificator for young crops of wheat in the ſpring, or to be uſed upon a fallow; in which caſe, the ſeed-box, the ladle cylinder, the coulters, the funnels, and harrows, are all taken away.

Plate XIII.

This ſide-view of the machine is repreſented, for the ſake of perſpicuity, with one ſeed-box only, one coulter, one funnel, one harrow, &c. whereas a complete machine is furniſhed with five coulters, five harrows, ſeven funnels, a ſeed-box in eight partitions, &c. with ladles of different ſizes, for different ſorts of grain and ſeeds.

Theſe machines (with five coulters, ſixteen guineas, with four coulters, fifteen guineas), equally excel in ſetting or planting all ſorts of grain and ſeeds, even carrot-ſeed, to exactneſs, after the rate of from eight to ten chain acres per day, with one man, a boy, and two horſes. They depoſite the grain or ſeed in any given quantity from one peck to three buſhels per acre, regularly and uniformly, and that without grinding or bruiſing the ſeed, and at any given depth, from half an inch to half a dozen inches, in rows at the diſtance of twelve, ſixteen and twenty-four inches, or any other diſtance. They are equally uſeful on all lands, ar durable, eaſy to manage, and by no means ſubject to be put out of repair.

The ladle cylinder D is furniſhed with cups or ladles

dles of four different ſizes for different ſorts of grain or ſeeds, which may be diſtinguiſhed by the numbers 1, 2, 3, 4.—N° 1. (the ſmalleſt ſize) is calculated for turnip-ſeed, clover-ſeed, cole-ſeed, rape, &c. and will ſow ſomething more than one pound per ſtatute acre. N° 2. for wheat, rye, hemp, flax, &c. and will ſow ſomething more than one buſhel per acre. N° 3. for barley; and will ſow one buſhel and a half per acre. N° 4. for beans, oats, peaſe, vetches, &c. and will ſow two buſhels per acre. Drill Huſbandry.

Notwithſtanding the above ſpecified quantities of grain or ſeeds, a greater or leſs quantity of each may be ſown at pleaſure, by ſtopping up with a little clay, or by adding a few ladles to each reſpective box. The grain or ſeeds intended to be ſown, muſt be put in thoſe boxes, to which the cups or ladles as above deſcribed reſpectively belong, an equal quantity into each box, and all the other boxes empty. The ladle cylinder may be reverſed, or turned end for end at pleaſure, for different ſorts of grain, &c.

For ſowing beans, oats, peaſe, &c. with a five-coulter machine, four large ladles muſt occaſionally be applied at equal diſtances round thoſe parts of the cylinder which ſubtend the two end boxes. And for ſowing barley, eight large ones muſt be applied as above; or four ladles, N° 2. to each of the wheat boxes. Theſe additional ladles are fixed on the cylinder with nails, or taken off in a few minutes; but for ſowing with a four-coulter machine, the above alterations are not neceſſary.

The funnels are applied to their reſpective places by correſponding numbers. Care ſhould be taken, that the points of the funnels ſtand directly behind the backs of

Drill Huſbandry.

the coulters, which is done by wedges being applied to one ſide or other of the coulters, at the time they are fixed in their reſpective places.

The machine being thus put together, which is readily and expeditiouſly done, as no ſeparate part will coincide with any other but that to which it reſpectively belongs, and an equal quantity of grain or ſeed in each of the reſpective boxes, the land alſo being previouſly ploughed and harrowed once or ſo in a place to level the ſurface; but if the land be very rough, a roller will beſt anſwer that purpoſe, whenever the land is dry enough to admit of it; and upon ſtrong clays, a ſpiked roller is ſometimes neceſſary to reduce the ſize of the large dry clods; which being done, the driver ſhould walk down the furrow or edge of the land, and having hold of the laſt horſe's head with his hand, he will readily keep him in ſuch a direction, as will bring the outſide coulter of the machine within three or four inches of the edge of the land or ridge, at which uniform extent he ſhould keep his arm till he comes to the end of the land; where, having turned round, he muſt come to the other ſide of his horſes, and walking upon the laſt outſide drill, having hold of the horſe's head with his hand, as before, he will readily keep the machine in ſuch a direction, as will ſtrike the ſucceeding drill at ſuch a diſtance from the laſt outſide one, or that he walks upon, as the coulters are diſtant from each other.

The perſon who attends the machine ſhould put down the lever H ſoon enough at the end of the land, that the cups or ladles may have time to fill, before he begins to ſow; and at the end of the land, he muſt apply his right hand to the middle of the rail between

the

the handles, by which he will keep the coulters in the ground, while he is lifting up the lever H with his left hand, to prevent the grain being ſcattered upon the headland, while the machine is turning round; this he will do with great eaſe, by continuing his right hand upon the rail between the handles, and applying his left arm under the left handle, in order to lift the coulter out of the ground while the machine is turning round. Drill Husbandry.

If there be any difficulty in uſing the machine, it conſiſts in driving it ſtraight. As to the perſon who attends the machine, he cannot poſſibly commit any errors, except ſuch as are wilful, particularly as he ſees, at one view, the whole proceſs of the buſineſs, viz. that the coulters make the drills of a proper depth; that the funnels continue open to convey the grain or ſeed into the drills; that the rakes or harrows cover the grain ſufficiently; and when ſeed is wanting in the lower boxes B, which he cannot avoid ſeeing, he readily ſupplies them from the upper boxes A, by applying his hand, as the machine goes along, to the lever C. The lower boxes B ſhould not be ſuffered to become empty before they are ſupplied with ſeed, but ſhould be kept nearly full, or within an inch or ſo of the edge of the box.

If chalk lines are made acroſs the backs of the coulters, at ſuch a diſtance from the ends as the ſeed ſhould be depoſited in the ground (viz. about two inches for wheat, and from two to three for ſpring corn,) the perſon that attends the machine will be better able to aſcertain the depth the ſeed ſhould be depoſited in the drills, by obſerving, as the machine goes along, whether the chalk lines are above or below the ſurface

of

Drill Husbandry.

of the land; if above, a proper weight muſt be applied to the lever, L, which will force the coulters into the ground; if below, the lever L and weight muſt be reverſed, which will prevent their ſinking too deep.

In different parts of the kingdom, lands or ridges are of different ſizes. Where the machine is too wide for the land, one or more funnels may occaſionally be ſtopped with a little looſe paper, and the ſeed received into ſuch funnel returned at the end of the land, or ſooner if required, into the upper ſeed-box. But for regularity and expedition, lands conſiſting of ſo many feet wide from outſide to outſide, as the machine contains coulters, when fixed at twelve inches diſtance, or twice or three times the number, &c. are beſt calculated for the machine. In wet ſoils or ſtrong clays, lands or ridges of the width of the machine, and in dry ſoils, of twice the width, are recommended. For ſowing of narrow high-ridged lands, the outſide coulters ſhould be let down, and the middle ones raiſed, ſo that the points of the coulters may form the ſame curve that the land or ridge forms. And the looſe ſoil harrowed down into the furrows ſhould be returned to the edges of the lands or ridges from whence it came, by a double mouldboard or other plough, whether the land be wet or dry.

Clover or other leys, intended to be ſown by the machine, ſhould be ploughed a deep ſtrong furrow and well harrowed, in order to level the ſurface, and to get as much looſe ſoil as poſſible for the coulters to work in; and when ſown, if any of the ſeed appears in the drills uncovered by reaſon of the ſtiff texture of the ſoil, or toughneſs of the roots, a light harrow may be

be taken over the land, once in a place, which will effectually cover the ſeed, without diſplacing it all in the drills. For ſowing leys, a conſiderable weight muſt be applied to the lever L, to force the coulters into the ground; and a ſet of wrought-iron coulters, well ſteeled, and made ſharp at the front edge and bottom, are recommended; they will pervade the ſoil more readily, conſequently require leſs draught, and expedite buſineſs more than adequate to the additional expence. Drill Huſbandry.

For every half acre of land intended to be ſown by the machine with the ſeed of that very valuable root, carrot, one buſhel of ſaw-duſt, and one pound of carrot-ſeed, ſhould be provided; the ſaw-duſt ſhould be made dry, and ſifted to take out all the lumps and chips, and divided into eight equal parts or heaps; the carrot-ſeed ſhould likewiſe be dried, and well rubbed between the hands, to take off the beards, ſo that it may ſeparate readily; and being divided into eight equal parts or heaps, one part of the carrot-ſeed muſt be well mixed with one part of the ſaw-duſt, and ſo on, till all the parts of carrot-ſeed and ſaw-duſt are well mixed and incorporated together; in which ſtate it may be ſown very regularly in drills at twelve inches diſtance, by the cups or ladles N° 2. Carrot-ſeed reſembling ſaw-duſt very much in its ſize, roughneſs, weight, adheſion, &c. will remain mixed as above during the ſowing; a ladleful of ſaw-duſt will, upon an average, contain three or four carrot-ſeeds, by which means the carrot-ſeed cannot be otherwiſe than regular in the drills. In attempting to depoſite ſmall ſeeds near the ſurface, it may ſo happen that ſome of the ſeeds may not be covered with ſoil; in which caſe, a light

Drill Husbandry.

light roller may be drawn over the land after the feed is ſown, which will not only cover the ſeeds, but will alſo, by levelling the ſurface, prepare the land for an earlier hoeing than could otherwiſe have taken place.

It has always been found troubleſome, ſometimes impracticable, to ſow any kind of grain or ſeeds (even broad-caſt) in a high wind. This inconvenience is entirely obviated by placing a ſcreen of any kind of cloth, or a ſack, ſupported by two uprights nailed to the ſides of the machine, behind the funnels, which will prevent the grain or ſeed being blown out of its direction in falling from the ladles into the funnels. Small pipes of tin may alſo be put on to the ends of the funnels, to convey the grain or ſeed ſo near the ſurface of the land, that the higheſt wind ſhall not be able to interrupt its deſcent into the drills.

Reſpecting the uſe of the machine, it is frequently remarked by ſome people not converſant with the properties of matter and motion, that the ſoil will cloſe after the coulters, before the ſeed is admitted into the drills. Whereas the very contrary is the caſe; for the velocity of the coulters in paſſing through the ſoil, is ſo much greater than the velocity with which the ſoil cloſes up the drills by its own ſpontaneous gravity, that the inciſions or drills will be conſtantly open for three or four inches behind the coulters; by which means, it is morally impoſſible (if the points of the funnels ſtand directly behind the coulters) that the ſeed, with the velocity it acquires in falling through the funnels, ſhall not be admitted into the drills.

Plate VIII. Fig. 10. is a new conſtructed ſimple hand-hoe, by which one man will effectually hoe two chain acres per day,

day, earthing up the ſoil at the ſame time to the rows of corn or pulſe, ſo as to cauſe roots to iſſue from the firſt joint of the ſtem, above the ſurface of the land, which otherwiſe would never have exiſted. Drill Huſbandry. Hand-hoe.

This hoe is worked much in the ſame manner as a common Dutch hoe, or ſcuffle, is worked in gardens. The handle is elevated or depreſſed, to ſuit the ſize of the perſon that works it, by means of an iron wedge being reſpectively applied to the upper or under ſide of the handle that goes into the ſocket of the hoe.

The wings or moulding plates of the hoe, which are calculated to earth up the ſoil to the rows of corn, ſo as to cauſe roots to iſſue from the firſt joint of the ſtem above the ſurface, which otherwiſe would not have exiſted, ſhould never be uſed for the firſt hoeing, but ſhould always be uſed for the laſt hoeing, and uſed or not uſed, at the option of the farmer, when any intermediate hoeing is performed.

Summary of the Operations neceſſary in executing the New Huſbandry with the Plough.

1. It is indiſpenſably neceſſary that the farmer be provided with a drill and hoe-plough. Summary o the operations.

2. The new huſbandry may be begun either with the winter or ſpring corn.

3. The land muſt be prepared by four good ploughings, given at different times, from the beginning of April to the middle of September.

4. Theſe ploughings muſt be done in dry weather, to prevent the earth from kneading.

5. The land muſt be harrowed in the ſame manner as if it were ſowed in the common way.

6. The

Drill Husbandry.

6. The rows of wheat ſhould be ſowed very ſtraight.

7. When the field is not very large, a line muſt be ſtrained acroſs it, by which a drill may be traced with a hoe for the horſe that draws the drill to go in; and when the rows are ſown, 50 inches muſt be left betwixt each drill. But, when the field is large, ſtakes at five feet diſtance from each other muſt be placed at the two ends. The workman muſt then trace a ſmall furrow with a plough that has no mouldboard, for the horſe to go in that draws the drill, directing himſelf with his eye by the ſtakes.

8. The ſowing ſhould be finiſhed at the end of September, or beginning of October.

9. The furrows muſt be traced the long way of the land, that as little ground as poſſible may be loſt in headlands.

10. The rows, if it can be done, ſhould run down the ſlope of the land, that the water may get the eaſier off.

11. The ſeed-wheat muſt be plunged into a tub of lime-water, and ſtirred, that the light corn may come to the ſurface and be ſkimmed off.

12. The ſeed muſt next be ſpread on a floor, and frequently ſtirred, till it is dry enough to run through the valves of the happer of the drill.

13. To prevent ſmut, the ſeed may be put into a ley of aſhes and lime.

14. Good old ſeed-wheat ſhould be choſen in preference to new, as it is found by experience not to be ſo ſubject to ſmut.

15. After the happers of the drill are filled, the horſe muſt go ſlowly along the furrow that was traced. That a proper quantity of ſeed may be ſown, the aperture

perture of the happer muſt be ſuited to the ſize of the grain. Drill Huſbandry.

16. As the drill is ſeldom well managed at firſt, the field ſhould be examined after the corn has come up, and the deficiencies be ſupplied.

17. Upon wet ſoils or ſtrong clays, wheat ſhould not be depoſited more than two inches deep, on any account whatever; nor leſs than two inches deep on dry ſoils. From two to three inches is a medium depth for all ſpring corn. But the exact depth at which grain ſhould be depoſited in different ſoils, from the lighteſt ſand to the ſtrongeſt clay, is readily aſcertained only by obſerving at what diſtance under the ſurface of the land, the ſecondary or coronal roots are formed in the ſpring.

18. Stiff lands, that retain the wet, muſt be ſtirred or hoed in October. This ſhould be done by opening a furrow in the middle of the intervals, and afterwards filling it up by a furrow drawn on each ſide, which will raiſe the earth in the middle of the intervals, and leave two ſmall furrows, next the rows, for draining off the water, which is very hurtful to wheat in winter.

19. The next ſtirring muſt be given about the end of March, with a light plough. In this ſtirring the furrows made to drain the rows muſt be filled up by earth from the middle of the interval.

20. Some time in May, the rows muſt be evened; which, though troubleſome at firſt, ſoon becomes eaſy, as the weeds are ſoon kept under by tillage.

21. In June, juſt before the wheat is in bloom, another ſtirring muſt be given with the plough. A deep

furrow

Drill Huſbandry.

furrow muſt be made in the middle of the intervals, and the earth thrown upon the ſides of the rows.

22. When the wheat is ripe, particular care muſt be taken, in reaping it, to trample as little as poſſible on the ploughed land.

23. Soon after the wheat is carried off the field, the intervals muſt be turned up with the plough, to prepare them for the ſeed. The great furrow in the middle muſt not only be filled, but the earth raiſed as much as poſſible in the middle of the intervals.

24. In September, the land muſt be again ſowed with a drill, as above directed.

25. In October, the ſtubble muſt be turned in for forming the new intervals; and the ſame management muſt be obſerved as directed in the firſt year.

To give an idea of the arguments by which the drill huſbandry was originally ſupported, we ſhall here take notice of a comparative view of the old and new methods of culture which was furniſhed for the editors of Mr Tull's Horſe-hoeing Huſbandry, by a gentleman who for ſome years practiſed both in a country where the ſoil was light and chalky, like that from which he drew his obſervations. It is neceſſary to remark, that in the new huſbandry every article is ſtated at its full value, and the crop of each year is four buſhels ſhort of the other; though, in ſeveral years experience, it has equalled and generally exceeded thoſe in the neighbourhood in the old way.

An Eſtimate of the Expence and Profit of 10 Acres of Land in 20 Years.

Drill Huſbandry.

I. In the old way.

	L.	*s.*	*d.*	*L.*	*s.*	*d.*
Firſt year, for wheat, coſts 33l. 5s.; viz.						
Firſt ploughing, at 6s. per acre	3	0	0			
Second and third ditto. at 8s. per acre -	4	0	0			
Manure, 30s. per acre	15	0	0			
				22	0	0
Two harrowings, and ſowing, at 2s. 6d. per acre.	1	5	0			
Seed, three buſhels per acre, at 4s. per buſhel. -	6	0	0			
Weeding, at 2s. per acre,	1	0	0			
Reaping, binding, and carrying, at 6s. per acre -	3	0	0			
				11	5	0
Second year, for barley, coſts 11l. 6s. 8d.; viz.						
Once ploughing at 6s. per acre	3	0	0			
Harrowing and ſowing, at 1s. 6d. per acre -	0	15	0			
Weeding, at 1s. per acre	0	10	0			
Seed, four buſhels per acre, at 2s. per buſhel -	4	0	0			
Cutting, raking, and carrying, at 3s. 2d. per acre -	1	11	8			
Graſs-ſeeds, at 3s. per acre	1	10	0			
				11	6	8
				44	11	8

Compara-tive view of the expence and profits of the old and new huſbandry.

Drill Husbandry.

				L.	s.	d.
Third and fourth years, lying in grafs, coft nothing: fo that the expence of ten acres in four years comes to 44l. 11s. 8d. and in twenty years to -				228	18	4
Firft year's produce is half a load of wheat per acre, at 7l.	35	0	0			
Second year's produce is two quarters of barley per acre, at 1l. - -	20	0	0			
Third and fourth years grafs is valued at 1l. 10s. per acre	15	0	0			
So that the produce of ten acres in four years is	70	0	0			
And in twenty years it will be				350	0	0
Deduct the expence, and there remains clear profit on ten acres in twenty years by the old way				127	1	8

II. In the new way.

Firft year's extraordinary expence is, for ploughing and manuring the land, the fame as in the old way, 22l.						
Ploughing once more, at 4s. per acre - -	2	0	0			
Seed, nine gallons per acre, at 4s. per bufhel -	2	5	0			
Drilling, at 7d. per acre -	0	5	10			
Hand-hoeing and weeding, at 2s. 6d. per acre -	1	5	0			
Carry over	5	15	10			

Drill Husbandry.

	L.	s.	d.	L.	s.	d.
Brought over	5	15	10			
Horſe-hoeing ſix times, at 10s. per acre	5	0	0			
Reaping, binding, and carrying, at 6s. per acre	3	0	0			
The ſtanding annual charge on ten acres, is	13	15	10			
Therefore the expence on ten acres in twenty years is				275	16	8
Add the extraordinaries of the firſt year, and the ſum is				297	16	8
The yearly produce is at leaſt two quarters of wheat per acre, at 1l. 8s. per quarter; which, on ten acres in twenty years, amounts to				560	0	0
Therefore, all things paid, there remains clear profit on ten acres in twenty years by the new way				262	3	4

Arguments in favour of the drill huſbandry.

"So that the profit on ten acres of land in twenty years, in the new way, exceeds that in the old by 135l. 1s. 8d. and conſequently is conſiderably more than double thereof; an ample encouragement to practiſe a ſcheme whereby ſo great advantage will ariſe from ſo ſmall a quantity of land, in the compaſs of a twenty-one years leaſe; one year being allowed, both in the old and new way, for preparing the ground.

"It ought withal to be obſerved, that Mr Tull's huſbandry requires no manure at all, though we have here, to prevent objections, allowed the charge thereof

Drill Husbandry.

for the firſt year; and moreover, that though the crop of wheat from the drill-plough is here put only at two quarters on an acre, yet Mr Tull himſelf, by actual experiment and meaſure, found the produce of his drilled wheat crop amounted to almoſt four quarters on an acre."

Expence and profit.

It appears alſo from a comparative calculation of expence and profit between the drill and common huſbandry, taken from Mr Baker's report to the Dublin Society of his experiments in agriculture for the year 1765, that there is a clear profit ariſing upon an Iriſh acre of land in 15 years in the drill huſbandry of 52l. 3s. 11d. and in the common huſbandry of 27l. 19s. 2d. and therefore a greater profit in the drill acre in this time of 24l. 4s. 9d. which amounts to 1l. 12s. 3½d. *per annum.* From hence he infers, that in every 15 years the fee-ſimple of all the tillage-lands of the kingdom is loſt to the community by the common courſe of tillage. In ſtating the accounts, from which their reſult is obtained, no notice is taken of fences, water-cutting the land, weeding and reaping, becauſe theſe articles depend on a variety of circumſtances, and will, in general, exceed in the common huſbandry thoſe incurred by the other.

Certainty of a crop.

Beſides, the certainty of a crop is greater in this new way than in the old way of ſowing; for moſt of the accidents attending wheat crops are owing to their being late ſown, which is neceſſary to the farmer in the old way; but in the horſe-hoeing method the farmer may plough two furrows whereon the next crop is to ſtand immediately after the firſt crop is off. In this manner of huſbandry, the land may be ploughed dry and drilled wet, without any inconvenience; and

the

the ſeed is never planted under the furrow, but placed juſt at the depth which is moſt proper, that is, at about two inches; in which caſe it is eaſy to preſerve it, and there is no danger of burying it. Thus the ſeed has all the advantage of early ſowing, and none of the diſadvantages that may attend it in the other way, and the crop is much more certain than by any other means that can be uſed. Drill Huſbandry.

The condition in which the land is left after the crop, is no leſs in favour of the horſe-hoeing huſbandry than all the other articles. The number of plants is the great principle of the exhauſting of land. In the common huſbandry, the number is vaſtly greater than in the drilling way, and three plants in four often come to nothing, after having exhauſted the ground as much as profitable plants; and the weeds which live to the time of harveſt in the common way, exhauſt the land no leſs than ſo many plants of corn; often much more. The horſe-hoeing method deſtroys all the weeds in the far greater part of the land, and leaves that part unexhauſted and perfectly freſh for another crop. The wheat plants being alſo but a third part of the number at the utmoſt of thoſe in the ſowing way, the land is ſo much the leſs exhauſted by them; and it is very evident from the whole, that it muſt be, as experience proves that it is, left in a much better condition after this than after the common huſbandry. Condition of the land.

The farmers who are againſt this method object, that it makes the plants too ſtrong, and that they are more liable to the blacks or blights of inſects for that reaſon; but as this allows that the hoeing can, without the uſe of dung, give too much nouriſhment, it is very plain that it can give enough; and it is the farmer's Objections and anſwers.

Drill Husbandry.

fault if he do not proportion his pains ſo as to have the advantage of the nouriſhment without the diſadvantages. It is alſo objected, that as hoeing can make poor land rich enough to bear good crops of wheat, it may make good land too rich for it. But if this ſhould happen, the ſowing of wheat on it may be let alone a while, and in the place of it the farmer may have a crop of turnips, carrots, cabbages, and the like, which are excellent food for cattle, and cannot be over-nouriſhed: or, if this is not choſen, the land, when thus made too rich, may ſoon be ſufficiently impoveriſhed by ſowing corn upon it in the common old way.

The method of horſe-hoeing huſbandry, ſo ſtrongly recommended by Mr Tull, is objected to by many on account of the largeneſs of the intervals which are to be left between the rows of corn. Theſe are required to be about five feet wide; and it is thought that ſuch wide ſpaces are ſo much loſt earth, and that the crop is to be ſo much the leſs for it. But it is to be obſerved, that the rows of corn ſeparated by theſe intervals need not be ſingle; they may be double, triple, or quadruple, at the pleaſure of the farmer; and four rows thus ſtanding as one will have the five feet interval but one-fourth of its bigneſs, as to the whole quantity, and it will be but as fifteen-inch intervals to plant in ſingle rows. Corn that is ſown irregularly in the common way, ſeems indeed to cover the ground better than that in rows; but this is a mere *deceptio viſus*; for the ſtalks of corn are never ſo thick as when they come out of one plant, or as when they ſtand in a row; and a horſe-hoed plant of corn will have 20 or 30 ſtalks in a piece of ground of the ſame quantity, where an unhoed plant will have only two or three ſtalks.

If

If theſe ſtalks of the hoed plant were ſeparated and planted over the intervals, the whole land would be better covered than it is in the common way; and the truth is, that though theſe hoed fields ſeem to contain a much leſs crop than the common ſown fields, yet they in reality do contain a much greater. It is only the different placing that makes the ſown crop ſeem the larger, and even this is only while both crops are young. Drill Huſbandry.

The intervals are not loſt ground, as is uſually ſuppoſed, but when well horſe-hoed they are all employed in the nouriſhment of the crop; the roots of the plants in the adjoining rows ſpreading themſelves through the whole interval, and drawing ſuch nouriſhment from it, that they increaſe accordingly. When the plants ſtand in the ſcattered way, as in common ſowing, they are too cloſe to one another; each robs its neighbours of part of their nouriſhment, and conſequently the earth is ſoon exhauſted, and all the plants half ſtarved. The cloſe ſtanding of them alſo prevents the benefit of after-tilling, as the hoe cannot be brought in, nor the ground by any means ſtirred between them to give it a new breaking, and conſequently afford them new food.

Experiments have abundantly proved, that in large grounds of wheat where the different methods have been tried, thoſe parts where the intervals were largeſt have produced the greateſt crops, and thoſe where hoeing was uſed without dung have been much richer than thoſe where dung was uſed without hoeing. If it were poſſible that plants could ſtand as thick, and thrive as well over the whole ſurface of the ground as they do in the rows ſeparated by theſe large intervals, the

Drill Huſbandry.

crops of corn produced would be vaſtly greater than any that have been heard of; but the truth is, that plants receive their growth not according to the ground they ſtand on, but to the ground they can extend their roots into; and therefore a ſingle row may contain more plants than a large interval can nouriſh, and therefore the ſame number that ſtands in that row, and no more than theſe, could be nouriſhed, if ſcattered over the whole interval: and they would be much worſe nouriſhed in that way; becauſe while the interval is void, the earth may be ſtirred about them, and new roots will be formed in great numbers from every one broken by the inſtruments, and new nouriſhment laid before theſe roots by the breaking the particles of earth, by which the plants will have ſupplies that they cannot have when ſcattered over the whole ſurface, becauſe the ground is then all occupied, and cannot be moved between the plants.

In what ſituations the new method is leſs proper.

All ſoils and all ſituations are not equally proper for this method of planting in rows, with large intervals and hoeing between. The lighteſt ſoils ſeem to be beſt for it, and the tough and wet clays the worſt. Such grounds as lie on the ſides of hills are alſo leſs proper than others for this work.

This method is not ſo proper in common fields, but that not in reſpect of the ſoil, but of the huſbandry of the owners, who are uſually in the old wa , and change the ſpecies of corn, and make it neceſſary to fallow every ſecond, third, or fourth year. Nevertheleſs it has been found by later experiments, that the intervals betwixt the rows of plants, as recommended by Mr Tull, were too great, perhaps double of what they ſhould be in the moſt profitable method of culture; by which means much

much leſs crops are obtained than might be produced at nearly the ſame expence. This has rendered the profits of the drill method much leſs than they would have been in a more judicious practice, and, conſequently, has proved a great diſadvantage to it in compariſon with the broad-caſt. Mr Tull was led into this, partly from the want of more perfect inſtruments for hoeing, and of ploughs proper for drilling. Drill Huſbandry.

To the preceding ſtatements, the following obſervations by Sir John Anſtruther, publiſhed among the Select Papers of the Bath Society, may not be improperly ſubjoined.

The ſlow progreſs which the drill-huſbandry has made in many parts of Great Britain ſince Mr Tull's time, he obſerves, has been principally owing to the want of proper drill-ploughs. Before drilling can become general, thoſe ploughs muſt be ſimple, ſuch as a common ploughman, accuſtomed to uſe ſtrong inſtruments, can uſe without breaking, and ſuch alſo as common workmen can eaſily make or repair. Mathematical accuracy he conſiders as not required for delivering the ſeed: for it matters very little whether there be a quarter of a peck more or leſs ſown, if it be delivered with tolerable regularity. He therefore had a plough made, according to his own directions, by a common plough-wright, of ſufficient ſtrength for any land made fit for turnips or wheat. It was tried on very rough ground unfit for ſowing, in order to aſcertain its ſtrength; and it had been uſed for eight years without its needing any repair. It is a double drill-plough, which ſows two ridges at a time, the horſe going in the furrow between them, and of courſe does not tread upon the ground intended to be ſown; which Obſervations by Sir John Anſtruther.

with

Drill Huſbandry.

with a ſingle drill muſt be the caſe, and does much harm by the horſes feet ſinking and making holes in the fine ground, which retain the water, and hurt the wheat when young.

He proceeds to obſerve, "That having read Mr Forbes upon the extenſive practice of the new huſbandry, and ſome other authors, who gave a more clear and diſtinct account of the different operations in drilling than had heretofore been given, I wiſhed to try them, and to adapt my plough to ſow the quantities therein directed. It was, however, adjuſted to ſow a ſmaller quantity, and the ſeed was not ſteeped.

"Not having ground ſo proper as I wiſhed, it was drilled on the ſide of a field, the ſoil of which was light and ſandy, and in ſuch bad order, that the preceding crop was a very indifferent one. It was therefore manured with a compoſt-dunghill.

"After croſs-ploughing and manuring, it was laid into four and a half feet ridges, then harrowed and drilled with one peck and a half of wheat on an acre and a quarter, which is nearly one peck and a fifth per Engliſh acre. It was drilled the 27th of October, and rolled after drilling. The crop was late in its appearance, and very backward in the ſpring.

"March 31ſt, it was horſe-hoed one furrow *from* the rows.

"April 8th, it was hand-hoed and weeded in the rows.

"April 25th, horſe-hoed again, laying a furrow back *to* the rows.

"May 15th, hand-hoed the ſecond time.

"June 2d, horſe-hoed *from* the rows.

"June

" June 12th, hand-hoed the third time.

" July 14th, horſe-hoed *to* the rows.

" At this laſt hoeing, as many of the ears were beaten down into the invervals by wind and rain, a man went before the horſe-hoe, and turned the ears back into their proper place.

" The crop, when reaped and thraſhed, yielded me 36 buſhels on one acre and a quarter, which is 28 buſhels and three pecks per acre; and the produce from one peck and half 96 for one.

" As the produce appeared ſo great, from land in ſuch bad order, it was carefully meaſured again, and found to be right. But this increaſe, though great, was not ſo large as Mr Craick of Glaſgow had without dung.

" Mr Randal ſays, 'It is an experimental fact, that on a fine loam exquiſitely prepared, 144 buſhels have been produced from one acre. And, I believe, it is not known what the increaſe may be brought to in rich lands by high cultivation.'

" Some years ſince, I had beans dropt alternately with potatoes, at two feet diſtance in the rows, which were three feet apart, and ploughed in the intervals. The land adjoining was ſown with beans and peaſe, which were a good crop; but thoſe ſown among the potatoes a better one. I pulled one ſtem of the beans planted with the potatoes, which had three branches riſing from the bottom, and it produced 225 beans. In all the trials of drilled beans, moſt of the ſtems had two branches, with many pods upon each.——From theſe and other inſtances, I believe it is not yet known to what increaſe grain may be brought by drilling, good cultivation, and manure.

" Horſe-

Drill Husbandry.

"Horſe-hoeing is certainly preferable to cloſe drilling or hand-hoeing; but the latter is ſuperior to broad-caſt.

"Horſe-hoeing the full depth increaſes the crop, by making it tiller or branch more than it otherwiſe would do; and the advantage is diſtinctly obſervable every hoeing by the colour of the grain. It prepares the ground for the next crop, at the ſame time that it increaſes the crop growing, which hand-hoeing does not, although it may deſtroy the weeds. Thus drilled ground is kept in a looſe open ſtate to receive the benefit of the influence of the air and weather, which broad-caſt has not; and it is evident, from certain experience, that crops may be drilled many years to good advantage without manure.

"Suppoſe the crops only 20 buſhels per acre, what courſe of broad-caſt crops will give 5l. an acre for the courſe? But ſuppoſe they are dunged the ſame as any ground in the moſt approved courſe, there is the greateſt reaſon to expect as much as in the above experiment, which is 28½, and at 5s. per buſhel amounts to 7l. 3s. 9d.

"Calculations may be of ſervice to thoſe who wiſh to try drilling, and have few books to direct them.

"One acre is 10 chains long, of 660 feet, or 220 yards long, and one yard broad, containing 4840 ſquare yards. Then if the ridge is four feet ſix inches, this makes 24 ridges, and three feet to ſpare. This length of 220 yards multiplied by 14 (the number of ridges), gives a length of yards 3080, to which add 146 for the ſpare three feet, and it will be 3226 yards. And as two rows are drilled on a ridge, the number of rows will be in length 6452 yards; but as a deduc-

tion

tion of 172 yards muſt be made for the head-ridges, ſuppoſed three yards each, &c. the whole length to be ſown will be 6280 yards clear. Now a gallon (Wincheſter) holds about 80,000 grains. The quantity recommended to be drilled by Mr Forbes and others, being ſix gallons, or two-thirds of a buſhel per acre, is nearly 78 grains to a yard, or 26 to a foot. But in my experiment, by this calculation, it was only about 11 grains to a foot: which is quite ſufficient, if the ſeed be good, and it be not deſtroyed by vermine. Drill Huſbandry.

"Now with regard to the quantity of land this drill-plough may ſow; if a horſe walks at the rate of two miles per hour, he goes 16 miles in eight hours, or 28,460 yards. As he ſows two ridges at once, this is ſeven lengths and two-thirds per acre, or 1686 yards to ſow an acre, being nearly 17 acres in a day.

"Four horſe-hoeings are calculated equal to two ploughings. In plain ploughing they ſuppoſe the ridge is ploughed with four furrows, or eight for twice ploughing. The four horſe-hoeings are eight furrows, equal to two ploughings.

"Mr Tull directs four hoeings, and Mr Forbes five. 1ſt, In November, when the plant has four blades. 2dly, In March, deep, and nearer the rows than the former. Both theſe hoeings ſhould be *from* the rows. 3dly, Hand-hoed when it begins to ſpindle, if the earth be crumbly, *to* the rows. 4thly, When it begins to bloſſom, *from* the rows, but as near to them as in the ſecond hoeing. 5thly, When done bloſſoming, to ripen and and fill the grain, *to* the rows.

"The laſt hoeing Mr Tull does not direct, but Mr Forbes adviſes it, as being of eſſential ſervice in filling the grain, and ſaving trouble in making the next ſeed-

furrows

Drill Husbandry.

furrows. They adviſe the patent or ſowing-plough for hoeing; and the expence is calculated by Mr Craick at one guinea per acre, reaping included.

"But let us ſuppoſe the following, which are the prices in the county I live in (Fife.)

	L.	*s.*	*d.*
Ploughing to form the ridges, -	0	4	0
Harrowing, - -	0	0	4
Four hoeings, equal to two ploughings,	0	8	0
Sowing, - - -	0	0	4
Hand-hoeing twice, - -	0	8	0
Seed, one peck and a half, at 5s. a buſhel,	0	1	10
Whole expence per acre,	1	2	6"

The drill and the broad-caſt methods more particularly compared.

Drill-huſbandry is, as a good writer has juſtly defined it, "*the practice of a garden brought into the field.*" Every man of the leaſt reflection muſt be ſenſible, that the practice of the garden is much *better* than that of the field, only a little more expenſive; but if (as is alleged) this extra expence be generally much more than repaid by the ſuperior goodneſs and value of drilled crops, it ought to have no weight in comparing the two modes of huſbandry.

In the broad-caſt method the land is often ſown in bad tilth, and always ſcattered at random, ſometimes by very unſkilful hands. In drilling, the land muſt be in fine order; the ſeed is ſet in trenches drawn regularly, all of nearly an equal depth, and that depth ſuited to the nature of each kind of ſeed. Theſe ſeeds are alſo diſtributed at proper diſtances, and by being equally and ſpeedily covered, are protected from vermine, and other injuries;

injuries; ſo that the practice of the garden is here exactly introduced into the field. Drill Huſbandry.

In the broad-caſt method the ſeed falls in ſome places too thick, in others too thin; and being imperfectly covered, a part of it is devoured by vermine which follow the ſower; another part is left expoſed to rain or froſt, or to heats, which greatly injure it. When harrowed, a great part of it (ſmall ſeeds eſpecially) is buried ſo deep, that if the ſoil be wet, it periſhes before it can vegetate.

Again: When thus ſown, there is no meddling with the crop afterwards, becauſe its growth is irregular. The ſoil cannot be broken, to give it more nouriſhment, nor can even the weeds be deſtroyed without much inconvenience and injury.

But in the drill-huſbandry the intervals between the rows, whether double or ſingle, may be horſe-hoed; and thereby nouriſhment may repeatedly be given to the plants, and the weeds almoſt totally deſtroyed.

The very ſame effects which digging has upon young ſhrubs and trees in a garden, will reſult from horſe-hoeing in a field, whether the crop be corn or pulſe: For the reaſon of the thing is the ſame in both caſes, and being founded in nature and fact, cannot ever fail. In drilling, no more plants are raiſed on the ſoil than it can well ſupport; and by dividing and breaking the ground they have the full advantage of all its fertility.

The plough prepares the land for a crop, but goes no further; for, in the broad-caſt huſbandry, it cannot be uſed: but the crop receives greater benefit from the tillage of the land by the horſe-hoe, while it is growing, than it could in the preparation. No care in tilling the land

Drill Huſbandry.

land previous to ſowing can prevent weeds riſing with the crop; and if theſe weeds be not deſtroyed while the crop is growing, they will greatly injure it. In the broad-caſt huſbandry this cannot be done; but in drilling, the horſe-hoe will effect it eaſily.

And what adds to the farmer's misfortune is, that the moſt pernicious weeds have ſeeds winged with down, which are carried by the wind to great diſtances; ſuch as thiſtles, ſow-thiſtles, colts-foot, and ſome others.

If the expence of horſe-hoeing be objected, there are two anſwers which may very properly be made: The firſt is, that this expence is much leſs than that of hand-hoeing, were it practicable, or of hand-weeding. The ſecond is, that it is more than repaid by the quantity of ſeed ſaved by drilling; to ſay nothing of the extra quantity and goodneſs of the crops, which are generally ſelf-evident.

Remarks on the above ſtatements.

UPON the whole, we have accounted it neceſſary to ſtate the nature of the drill or horſe-hoeing huſbandry, together with the arguments in ſupport of it, and this chiefly for two reaſons: Firſt, becauſe it ſtill has a conſiderable number of very reſpectable agriculturiſts in different parts of the iſland who adhere to it; and, ſecondly, becauſe the art itſelf was undoubtedly at one period greatly indebted to it. It was of great uſe in exciting ſuſpicions concerning the correctneſs of the old modes of cultivation, and in directing the views both of philoſophers and of farmers towards improvement in general. It is to be obſerved, however, that a part of the celebrity of the horſe-hoeing huſbandry undoubtedly ariſes from comparing it with the defective modes of cultivation which ordinarily prevailed at the time of its

its introduction; but ſince the diſcovery of the value of turnips and clover, as preparations for barley and wheat, the character of the broad-caſt huſbandry has greatly altered. In conſequence of an endleſs variety of trials, by ſkilful and unprejudiced men, the horſe-hoeing method is not abſolutely rejected, though it is reſtricted in its application. With regard to white crops, it ſeems upon the whole juſtly to be diſregarded; though it is retained for potatoes, cabbages, and beans, and frequently alſo turnips. With regard to theſe, it poſſeſſes this great advantage, that it becomes a moſt valuable ſubſtitute for the expenſive requiſite of a ſummer fallow, which would otherwiſe be neceſſary to clean and pulverize the ſoil. Drill Huſbandry.

It may be proper here to remark, however, that the drill huſbandry is by no means a modern European invention. In China it is univerſally practiſed. It is now uſed in the Carnatic, and in all probability has exiſted among the induſtrious nations of India from a very early period. It is uſed not only for all grains, but alſo for the culture of tobacco, cotton, and the caſtor-oil plant. Beſides the drill-plough, and the common plough, the Indians uſe a third, with a horizontal ſhare, which immediately follows the drill-plough at work. It is ſet into the earth about the depth of 7 or 8 inches, and paſſes under three drills at once. It operates by agitating the earth, ſo as to make the ſides of the drills fall in and cover the ſeed, which it does ſo effectually as ſcarcely to leave any traces of a plough. The drill huſbandry not a modern diſcovery.

PART II.

CULTIVATION OF VEGETABLES MORE PROPERLY ARTICLES OF COMMERCE.

THESE in general are ſuch as cannot be uſed for food; and are principally flax, hemp, rape, hops, and timber of various kinds. Of each of theſe we ſhall treat particularly in the following ſections.

SECT. I.

OF FLAX AND HEMP.

Flax and hemp.

FLAX is cultivated not only with a view to the common purpoſes of making linen, but for the ſake of its ſeed alſo; and thus forms a moſt extenſive article of commerce, all the oil uſed by painters, at leaſt for common purpoſes, being extracted from this ſeed. The cake which remains after the extraction of the oil is in ſome places uſed as a manure, and in others ſold for fattening of cattle. In the Vale of Glouceſter, Mr Marſhal informs us, that it is, next to hay, the main article of ſtall-fattening; though the price is now become ſo great, that it probably leaves little or no profit to the conſumer, having within a few years riſen from three

Linſeed-cake, linſeed itſelf, and linſeed oil, uſed for fattening cattle.

three guineas to ſix and ſix and a half, and the loweſt price being five guineas per ton; and even this is lower than it was lately. Hence ſome individuals have been induced to try the effect of linſeed itſelf boiled to a jelly, and mixed with flour, bran, or chaff, with good ſucceſs, as Mr Marſhal has been informed; and even the oil itſelf has been tried for the ſame purpoſe in Herefordſhire. Though this plant is in univerſal culture over the whole kingdom, yet it appears by the vaſt quantity imported, that by far too little ground is employed in that way. As Mr Marſhal takes notice of its culture only in the county of Yorkſhire, it probably does not make any great part of the huſbandry of the other counties of which he treats; and even in Yorkſhire he tells us, that its cultivation is confined to a few diſtricts. The kind cultivated there is that called *blea line*, or *the blue or lead-coloured flax*, and this requires a rich dry ſoil for its cultivation. A deep, fat, ſandy loam is perhaps the only ſoil on which it can be cultivated with advantage. If ſown upon old corn land, it ought to be well cleaned from weeds, and rendered perfectly friable by ſummer-fallow. Manure is ſeldom or ever ſet on for a line crop: and the ſoil proceſs conſiſts generally of a ſingle ploughing. The ſeed-time is in the month of May, but much depends on the ſtate of the ſoil at the time of ſowing. "It ſhould neither be wet nor dry; and the ſurface ought to be made as fine as that of a garden bed. Not a clod of the ſize of an egg ſhould remain unbroken." Two buſhels of ſeed are uſually ſown upon an acre: the ſurface, after being harrowed, is ſometimes raked with garden or hay rakes; and the operation would be ſtill more complete if the clods and other obſtructions,

Flax and Hemp.

Culture of flax in Yorkſhire.

Flax and Hemp.

which cannot be eaſily removed, were drawn into the interfurrows. A light hand-roller uſed between the final raking and harrowing would much aſſiſt this operation. The chief requiſite during the time of vegetation is weeding, which ought to be performed with the utmoſt care; and for this reaſon it is particularly requiſite that the ground ſhould be previouſly cleanſed as well as poſſible, otherwiſe the expence of weeding becomes too great to be borne, or the crop muſt be conſiderably injured. It is an irreparable injury, if, through a dry ſeaſon, the plants come up in two crops; or if by accident or miſmanagement they be too thin. The goodneſs of the crop depends on its running up with a ſingle ſtalk without branches: for wherever it ramifies, there the length of the line terminates; and this ramification is the conſequence of its having too much room at the root, or getting above the plants which ſurround it. The branches are never of any uſe, being unavoidably worked off in dreſſing; and the ſtem itſelf, unleſs it bear a due proportion to the length of the crop, is likewiſe worked off among the refuſe. This ramification of the flax will readily be occaſioned by clods on the ground when ſown. A ſecond crop is very ſeldom attended with any profit; for being overgrown with the ſpreading plants of the firſt crop, it remains weak and ſhort, and at pulling time is left to rot upon the land.

Flax is injured not only by drought but by froſt, and is ſometimes attacked, even when got five or ſix inches high, by a ſmall white ſlug, which ſtrips off the leaves to the top, and the ſtalks bending with their weight are thus ſometimes drawn into the ground. Hence, if the crop does not promiſe fair at weeding time,

time, our author adviſes not to beſtow farther labour and expence upon it. A crop of turnips or rape will generally pay much better than ſuch a crop of flax. The time of flax-harveſt in Yorkſhire is generally in the latter end of July or beginning of Auguſt. Flax and Hemp.

On the whole, our author remarks, that "the goodneſs of the crop depends in ſome meaſure upon its length; and this upon its evenneſs and cloſeneſs upon the ground. Three feet high is a good length, and the thickneſs of a crow's quill a good thickneſs. A fine ſtalk affords more line and fewer ſhivers than a thick one. A tall thick ſet crop is therefore deſirable. But unleſs the land be good, a thick crop cannot attain a ſufficient length of ſtem. Hence the folly of ſowing flax on land which is unfit for it. Nevertheleſs, with a ſuitable ſoil, a ſufficiency of ſeed evenly diſtributed, and a favourable ſeaſon, flax may turn out a very profitable crop. The flax crop, however, has its diſadvantages: it interferes with harveſt, and is generally believed to be a great exhauſter of the ſoil, eſpecially when its ſeed is ſuffered to ripen. Its cultivation ought therefore to be confined to rich graſs-land diſtricts, where harveſt is a ſecondary object, and where its exhauſtion may be rather favourable than hurtful to ſucceeding arable crops, by checking the too great rankneſs of rich freſh broken ground. Mr Marſhal's remarks on flax crops.

In the 5th volume of Bath Papers, Mr Bartley, near Briſtol, gives an account of the expences and produce of five acres of flax cultivated on a rich loamy ſand. The total expence was 42l. 13s. 4d.; the produce was ten packs of flax at 5l. 5s. value 52l. 10s. 35 buſhels of linſeed at 5s. value 8l. 15s.: the net profit therefore was 18l. 11s. 8d. or 4l. 13s. 4d. per acre. This gentleman is of opinion that flax-growers ought to make it Mr Bartley's experiments.

Flax and Hemp.

their ſtaple article, and conſider the other parts of their farm as in ſubſerviency to it.

Remarks by a Dorſetſhire gentleman.

In the ſecond volume of Bath Papers, a Dorſetſhire gentleman, who writes on the culture of hemp and flax, gives an account ſomewhat different from that of Mr Marſhal. Inſtead of *exhauſting* crops, he maintains that they are both *ameliorating* crops if cut without feeding; and as the beſt crops of both are raiſed from foreign ſeed, he is of opinion that there is little occaſion for raiſing it in this country. A crop of hemp, he informs us, prepares the land for flax, and is therefore clear gain to the farmer. "That theſe plants impoveriſh the ſoil," he repeats, "is a mere vulgar notion, devoid of all truth.—The beſt hiſtorical relations, and the verbal accounts of honeſt ingenious planters, concur in declaring it to be a vain prejudice, unſupported by any authority; and that theſe crops really meliorate and improve the ſoil." He is likewiſe of opinion, that the growth of hemp and flax is not neceſſarily confined to rich ſoils, but that they may be cultivated with profit alſo upon poor ſandy ground, if a little expence be laid out in manuring it. "Spalding-moor in Lincolnſhire is a barren ſand; and yet with proper care and culture it produces the beſt hemp in England, and in large quantities. In the iſle of Aſholme, in the ſame county, equal quantities are produced; for the culture and management of it is the principal employ of the inhabitants; and, according to Leland, it was ſo in the reign of Henry VIII. In Marſhland. the ſoil is a clay or ſtrong warp, thrown up by the river Ouſe, and of ſuch a quality, that it cracks with the heat of the ſun, till a hand may be put into the chinks; yet if it be once covered with the

Flax and hemp may be cultivated upon poor as well as rich ſoils.

hemp

hemp or flax before the heats come on, the ground will not crack that ſummer. When the land is ſandy, they firſt ſow it with barley, and the following ſpring they manure the ſtubble with horſe or cow dung, and plough it under. Then they ſow their hemp or flax, and harrow it in with a light harrow, having ſhort teeth. A good crop deſtroys all the weeds, and makes it a fine fallow for flax in the ſpring. As ſoon as the flax is pulled, they prepare the ground for wheat. Lime, marl, and the mud of ponds, is an excellent compoſt for hemp-lands." Flax and Hemp.

Our author takes notice of the vaſt quantity of flax and hemp, not leſs than 11,000 tons, imported in the year 1763 into Britain; and complains that it is not raiſed in the iſland, which he thinks might be done, though it would require 60,000 acres for the purpoſe. He obſerves, that the greater part of thoſe rich marſhy lands lying to the weſt of Mendip hills are very proper for the cultivation of hemp and flax; and if laid out in this manner could not fail of turning out highly advantageous both to the landholders and the public at large. "The vaſt quantities of hemp and flax (ſays he) which have been raiſed on lands of the ſame kind in Lincolnſhire marſhes, and the fens of the Iſle of Ely and Huntingdonſhire, are a full proof of the truth of my aſſertion. Many hundreds of acres in the above-mentioned places, which, for paſturage or grazing, were not worth more than twenty or twenty-five ſhillings per acre, have been readily let at 4l. the firſt year, 3l. the ſecond, and 2l. the third. The reaſon of this ſuppoſed declining value of land, in proportion to the number of years ſown with flax, is, that it is uſual with them to feed it for the purpoſe of making oil, that being Vaſt quantities of flax and hemp imported into Britain.

Flax and Hemp.

ing the principal cauſe of the land being thereby impoveriſhed.

It is certain, that the quantity of hemp exported from St Peterſburgh in Britiſh ſhips has continued to increaſe, even in time of peace, ſo that in 1785 the quantity of hemp exported from Peterſburgh in Britiſh ſhips was as follows:

	Poods.
Of clean hemp, -	1,038,791
Outſhot, - -	37,382
Half clean, - -	18,374
Hemp codille, - -	19,251
	1,113,798

There are 63 poods to a ton, conſequently the whole amounted to 17,695 tons; and it is ſaid that this quantity has ſince been tripled and quadrupled. It is therefore an object of great national importance to conſider, whether flax and hemp might not be profitably reared in our own country without producing any alarm concerning their tendency to exhauſt the ſoil. With this view we ſhall here ſtate the ſubſtance of a report made by Mr Durno, Britiſh conſul at Pruſſia in 1789, to the lords of the Committee of Council for Trade, concerning the method of cultivating flax and hemp in Pruſſia, Ruſſia, and Poland.

Mr Durno's report on the culture of flax and hemp in Pruſſia, &c.

A black, not moraſſy, open gravelly ſoil is preferred, as flax and hemp become exuberant and coarſe on too rich a ſoil. To aſcertain the proper middle degree of ſtrength of ſoil, previous crops of grain are taken. On a vigorous ſoil wheat is firſt ſown; then rye, barley, oats; and laſt of all flax or hemp. Two ſucceſſive

crops

crops of hemp are taken if the land is intermediately dunged. For one crop of flax, it is not dunged at all. On a ſoil of leſs ſtrength, flax and hemp are ſown immediately after a winter crop of rye, the land being ploughed in autumn, if the weather allows; if not, in ſpring. It is then harrowed and manured, and again ploughed immediately before ſowing. Another winter crop of rye may immediately be ſown in the ſame field after drawing the flax or hemp; but after the flax, dung is in this caſe neceſſary. A field that has been laid down in fallow, if only ploughed up, yields a better crop of flax than if manured and cultivated in the above or any other way. Flax and hemp are ſown from the 25th of May to the 10th of June, and the flax is reaped in the end of Auguſt, and hemp in the end of September. Flax and Hemp.

As to their effects on the ſoil, no kind of grain can be ſown immediately after a crop of flax without dunging, but after one of hemp, any grain, and even hemp itſelf, may be ſown without manure. Hemp cleans the ground by ſuffocating, by its broad leaves, all ſorts of weeds or undergrowth; but flax muſt be weeded once or twice before it blooms. Flax is plucked when the ſtalk becomes yellowiſh, the pods brown, and the ſeed hard and full bodied. For finer flax, the ſtalk is pulled while yet green; but the ſeed is then ſacrificed, and fit only for cruſhing for oil, of which it produces a ſmall quantity. Hemp is alſo plucked or drawn when the ſtalk and pods have changed colour. If the flax is very dry when plucked, the ſeed is ſtripped off immediately; if not, it is allowed to dry on the field. The ſeed-pods are ſpread thinly on a floor, where they are turned twice a-day, till ſo dry that they open of themſelves;

Flax and Hemp.

ſelves; when it is thraſhed and cleaned like other grain. To gain the hemp-ſeed, the hemp itſelf, when plucked, is ſet on end againſt any convenient place. The roots, and top-ends are then cut off. The roots are thrown away, and the top-ends are thraſhed out and cleaned. The ſeed is apt to be ſpoiled by remaining in a moiſt ſtate for any length of time.

As ſoon as the ſeed has been gained, the flax and hemp are ſteeped in water till the flax ſeparate from the rind, and the hemp till the harl ſprings from the ſtalk. In ſoft water, in warm weather, nine or ten days are ſufficient for this purpoſe. In hard water, with cold weather, from fourteen days to three weeks are requiſite. Stagnate is preferred to running water; but fiſh ponds and the drinking places of cattle muſt be avoided, as the fiſh would be deſtroyed, and the water would be rendered unwholeſome and unpalatable to the cattle; but a muddy or ſlimy bottom is preferred. In the ſouthern provinces of Poland, as Volhinia, Podolia, &c. ſteeping is not practiſed, on the ſuppoſition that it weakens the harl and darkens the colour, though this idea ſeems to have no foundation.

After being taken out of the ſteep, the flax is dried on a graſs field; after which it is gathered up into ſmall ſtacks; but the hemp, inſtead of being ſpread out on a field, is ſet up againſt the walls of buildings till it is alſo dried, after which they are both houſed.

It is generally underſtood in theſe countries, that the cultivation of flax and hemp is more profitable than that of any kind of grain.

The following is deſcribed by an American gentleman,

man, Edward Antill, Eſq.*, as the beſt mode of raiſing hemp in that country. The ſoil ought by no means to be wet, but ought to be well dunged, and rendered ſtrong and mellow. "Some time in May, the ground being moiſt and in a vegetating ſtate, but by no means wet, muſt be well ploughed, the furrows muſt be cloſe and even, and the ſoil muſt lie light and mellow; it muſt then be ſown very even, with two buſhels of ſeed upon one acre. A man with an iron-tooth harrow follows the ſower, and harrows in the ſeed with two horſes, without any balks; for the leſs the ground is trampled the better. If harrowing one way be not ſufficient to cover the ſeed, though it would be beſt if that could be done, it muſt be croſs harrowed. The ground being moiſt, as I ſaid before, but by no means ſo wet as to clod, which would ruin the crop, the ſeed will all ſtart and come up together, which is a ſure ſign of a good crop, and nothing after that, but too much wet, will hurt it; for hemp thus come up bids defiance to weeds and graſs of every kind. Its growth is ſo quick, and it ſo effectually ſhades the ground, that nothing below can riſe, or ſhow its head; and it ſo preſerves all the moiſture below, that the hotter and drier the weather the faſter it grows. Whereas, if the ſeed be ſown when the ground is dry, the ſeed that lies deepeſt where the moiſture is, will come up firſt, and theſe plants will ſhade and ſtarve thoſe that come up after; by which means the firſt comers will be too large, and the laſt will be much too ſmall, ſo that the crop will be greatly damaged every way: ſo much depends upon this

Flax and Hemp.

American culture of hemp.

* *American Philoſophical Society's Tranſactions.*

Flax and Hemp.

this one circumſtance of ſowing the ſeed when the ground is moiſt and fit to receive it. The crop thus rightly managed will ſtand as thick as very good wheat, and be from four to ſix feet high, according to the ſtrength of the ground, and the ſtems will not be thicker than a good wheat ſtraw; by this means the hemp will be finer; it will yield the greater quantity; and it may be plucked from the ground, like flax, which will be a great ſaving. But if it be ſown thin, that is, one buſhel to an acre, which is the common practice, it grows large: the hemp is harſh and coarſe, and then it muſt be cut with hooks, which occaſions great waſte; for four or five inches above the ground is left by way of ſtubble, which contains the beſt and heavieſt parts of the hemp.

"When the hemp has got its growth, and is fit to be plucked, which you will know by the under leaves of the carle or male hemp turning yellow and falling off, the ſooner it is pulled the better. It muſt then be bound up with ſtraw bands, in ſingle band ſheaves, rather ſmall than large, and each ſheaf muſt be bound in two places, and the ſooner it is carried to the water to rot the better. Water-rotted hemp, if it be rightly managed, is every way better than that which is rotted on the ground; there is leſs waſte in it, when it comes to be dreſſed; it looks brighter and fairer to the eye; it is eſteemed to be ſtronger and more durable, and it always fetches a better price; beſides it is much ſooner done, and it is rotted more even and alike, and with greater certainty and exactneſs. Hemp may be rotted in ſtagnated or ſtanding water; ſuch as ponds, pools, or broad deep ditches; and in ſuch water it is generally four or five days and nights in rotting, and ſometimes

longer,

longer, according to the heat or coolneſs of the weather. It may alſo be rotted in running water, as in a brook or river; and in ſuch water three or four days and nights are ſufficient, according to the weather. To know whether the hemp is rotted enough in either caſe, take a middling handful out of the middle row, and try with both your hands to ſnap it aſunder; if it breaks eaſy, it is rotted enough; but if it yet appear pretty ſtrong, it is not, and muſt lie longer, till it breaks with eaſe; then it muſt be taken out, and dried as ſoon as poſſible. In handling the ſheaves, take hold of the bands, and ſet them upright againſt a fence, if one be near, or lay them down upon the graſs for the water to drain off; then unbind them carefully, open and ſpread them, that they may dry thoroughly; then bind them up again, and houſe them in a dry tight place. The reaſon of handling the hemp in this careful manner is, that when it is well rotted whilſt it is wet the lint comes off with the leaſt touch; therefore, if it be handled roughly, or if, while it is wet, it be thrown into a cart, and carried to a diſtance to be unbound and dried, it will be greatly hurt, and the owner will receive great damage; but, when it is dry, it may be handled with ſafety. Flax and Hemp.

"If the hemp be rotted in a brook or running water, the ſheaves muſt be laid acroſs the ſtream; for, if they be laid down lengthways with the ſtream, the current of the water will waſh away the lint and ruin the hemp; it muſt be laid down, heads and points, two, four, or ſix thick, according to the depth of the water, and the quantity of hemp. If the bottom of the river be ſand, gravel, or mud, three good ſtrong ſtakes muſt be driven down at each end, above and below, and three long

ſtrong

Flax and Hemp.

ſtrong poles muſt be laid on the hemp, and faſtened well to the ſtakes, in ſuch a manner as to force down the hemp under water, where it is to remain till it is rotted enough; though, if a muddy ſtream could be avoided, it would be beſt, becauſe it is apt to foul and ſtain the hemp. If the bottom of the ſtream be rocky or ſtony, ſo that ſtakes cannot be driven down to ſecure the hemp under water, and prevent its floating away, then a rough wall muſt be made at the lower end of the hemp, and along the ſide, to keep it in; and ſtrong poles or rails muſt be laid upon the top of the hemp, and pretty heavy ſtones upon them, ſo as to ſink the hemp under water, where it muſt lie till it is rotted enough."

Culture of flax in Ireland.

To this we ſhall add a conciſe ſtatement of the mode of cultivating flax in Ireland. A good crop of flax is there expected from any ſtrong clays that are fit for the growth of corn; but an open black loamy ſoil, enriched by having lain long in paſture, is preferable. The ground muſt be in fine tilth, and as free from weeds as poſſible. Potatoes uſually precede flax, though turnips, beans, or any manured crop, are a good preparation; but the firſt or ſecond crop after paſture is preferred to any of theſe. Stubble lands, that have been long in tillage, may, by proper preparation, bring a crop; but it is apt to fail in ſuch ſituations, the ſtalks turning to a reddiſh colour, called *firing*, before it ripens; upon which it muſt immediately be pulled. Two buſhels of ſeed are uſed to the Engliſh acre, unleſs for the purpoſe of a very fine manufacture; in which caſe a large quantity of ſeed is uſed, and the flax is pulled very green. The ſeaſon of ſowing is the firſt fine weather after the middle of March. The

moſt approved mode of culture is in beds about ſix feet broad, covering the ſeed about an inch and a half deep, with earth ſhoveled out of the furrows: but the moſt ordinary mode is to ſow on common ridges, and to harrow in the ſeed. Before the flax is five inches high it ſhould be carefully hand-weeded; and, if any part lodges, it ſhould be turned over. The produce is uſually worth 7l. ſterling the Engliſh acre. The crop ſhould ſtand till the lower part of the ſtalk becomes yellowiſh, and the under leaves begin to wither, unleſs the ſeed is to be preſerved, which is done by rippling it through an iron comb, and the flax may be ſteeped immediately after it is pulled. Turf-bog water, if clear, anſwers well; but foul ſtagnated water ſtains the flax. Too pure a ſpring is injurious. A reſervoir dug in clay is preferred. The time of lying in the ſteep depends upon the quality of the water and the ſtate of the weather. It is dried on graſs by being ſpread thin. Artificial heat has been recommended for drying flax; but no good form of it has been ſuggeſted. Flax and Hemp.

In addition to what is here ſtated, it may not be improper to take notice of a mode of weeding flax that has frequently been practiſed in Scotland. It conſiſts of turning a flock of ſheep at large into the field. They will not taſte the young flax plants, but they carefully ſearch for the weeds, which they devour. It may alſo be remarked, that for drying flax in wet ſeaſons, the ſteam kiln formerly propoſed would be a valuable inſtrument. Sheep employed to weed flax.

SECT.

Rape or Cole-Seed.

SECT. II.

RAPE OR COLE-SEED

THIS, as well as linſeed, is cultivated for the purpoſe of making oil, and will grow almoſt anywhere. Mr Hazard informs us *, that in the north of England the farmers pare and burn their paſture lands, and then ſow them with rape after one ploughing; the crop commonly ſtanding for ſeed, which will bring from 25l. to 30l. per laſt (80 buſhels). Poor clay, or ſtone-braſh land, will frequently produce from 12 to 16 or 18 buſhels per acre, and almoſt any freſh or virgin earth will yield one plentiful crop; ſo that many in the northern counties have been raiſed, by cultivating this ſeed, from poverty to the greateſt affluence. The ſeed is ripe in July or the beginning of Auguſt; and the thraſhing of it out is conducted with the greateſt mirth and jollity.

Advantage of cultivating rape-ſeed.

The rape being fully ripe, is firſt cut with ſickles, and then laid thin upon the ground to dry; and when in proper condition for thraſhing, the neighbours are invited, who readily contribute their aſſiſtance. The thraſhing is performed on a large cloth in the middle of the field, and the ſeed put into the ſacks and carried home. It does not admit of being carried from the field in the pod in order to be thraſhed at home, and therefore

Of cutting and thraſhing the rape-ſeed.

* *Bath Papers*, vol. iv.

fore the operation is always performed in the field; and by the number of aſſiſtants procured on this occaſion, a field of 20 acres is frequently thraſhed out in one day. The ſtraw is burnt for the ſake of its alkali, the aſhes being ſaid to equal the beſt kind of thoſe imported from abroad. Rape or Cole-Seed.

The proper time for ſowing rape is the month of June; and the land ſhould, previous to the ſowing, be twice well ploughed. About two pounds of ſeed are ſufficient for an acre; and, according to our author, it ſhould be caſt upon the ground with only the thumb and two fore fingers; for if it be caſt with all the fingers, it will come up in patches. If the plants come up too thick, a pair of light harrows ſhould be drawn along the field lengthwiſe and croſswiſe; by which means the plants will be equally thinned; and when the plants which the harrows have pulled up are withered, the ground ſhould be rolled. A few days after, the plants may be ſet out with a hoe, allowing 16 or 18 inches diſtance betwixt every two plants. Of ſowing it.

Mr Hazard ſtrongly recommends the tranſplanting of rape, having experienced the good effects of it himſelf. A rood of ground, ſown in June, will produce as many plants as are ſufficient for 10 acres; which may be planted out upon ground that has previouſly borne a crop of wheat, provided the wheat be harveſted by the middle of Auguſt. One ploughing will be ſufficient for theſe plants; the beſt of which ſhould be ſelected from the ſeed-plot, and planted in rows two feet aſunder and 16 inches apart in the rows. As rape is an excellent food for ſheep, they may be allowed to feed upon it in the ſpring; or the leaves might be gathered, and given to oxen or young cattle: freſh Tranſplanting recommended. Sheep may be fed in the ſpring with rape.

Rape or Cole, Seed.

leaves would ſpread again from the ſame ſtalks, which in like manner might be fed off by ewes and lambs in time enough to plough the land for a crop of barley and oats. Planting rape in the beginning of July, however, would be moſt advantageous for the crop itſelf, as the leaves might then be fed off in the autumn, and new ones would appear in the ſpring. Our author diſcommends the practice of ſowing rape with turnips, as the crops injure one another. "Thoſe who look for an immediate profit (ſays he), will undoubtedly cultivate rape for ſeed; but perhaps it may anſwer better in the end to feed it with ſheep: the fat ones might cull it over firſt, and afterwards the lean or ſtore ſheep might follow them, and be folded thereon; if this is done in the autumn ſeaſon, the land will be in good heart to carry a crop of wheat; or, where the rape is fed off in the ſpring, a crop of barley might follow. In either caſe rape is profitable to the cultivator; and when it is planted, and well earthed round the ſtems, it will endure the ſevereſt winter; but the ſame cannot be advanced in favour of that which is ſown broadcaſt.

Northamptonſhire culture.

The mode of cultivating and uſing rape or cole for the purpoſe of fattening ſheep, is thus deſcribed by a a Northamptonſhire farmer *. "The preparation for it is exactly the ſame as for turnips; and it ſhould be hoed in the ſame ſtages of its growth, but not more than ſix inches aſunder. The quantity of ſeed, half a peck, Wincheſter, upon a ſtatute acre.

"The time for ſowing for the fattening ſheep is about

* *Annals of Agriculture*, vol. xxiv.

about midſummer, or ten days or a fortnight before or after, according as the land is in condition; and, for this purpoſe the ſtrongeſt and beſt of the land is ſelected. Such as is meant for lamb hogs or ſtore ſheep, is ſowed later, and upon inferior land. The reaſon of this diſtinction is, that, being a much ſtronger food than any other vegetable, the ſheep are required to be in a ſtate of forwardneſs, proportioned in ſome degree to the luxuriance of the plant; for if the ſheep are poor, and the cole-ſeed is ſtrong, they will either ſcour themſelves to death, or die of the rack; a ſpecies of mortification brought on by thriving too faſt. Indeed it is generally underſtood, that there is always a degree of hazard attending it on this account; and I have known very great loſſes ſuſtained by the death of ſheep; but I think they have been owing to injudicious management. I have uſed it myſelf for many years, and never experienced any loſs but once, which was the year before laſt; and that I ſuppoſe to have been owing to inattention, in my abſence, to my uſual plan of conducting this part of the grazing buſineſs, which I will endeavour to explain. Rape or Cole-Seed.

"My portion of land uſed with cole-ſeed is about 30 acres, and the number of ſheep intended to be wintered from two hundred to three hundred. About the 10th of Auguſt I begin to draw the leaneſt of the ſheep, and turn them into the cole-ſeed, beginning with ten only, which go over the whole ground if they pleaſe; in a few days ten more are turned in; and ten at a time, until about half of the whole number is upon the cole-ſeed; always taking care to keep back the forwardeſt and fatteſt of the ſheep; which laſt are kept at graſs perhaps till near Chriſtmas; and by that time the others, which

Rape or Cole-Seed.

were the leaneſt at the outſet, will be completely fat for market; they are never moved or driven about, or penned, for fear of heating them; but the number wanted to be taken to market is carefully ſeparated, and put into the neareſt paſture-land, to empty themſelves a few days before they go into the drovers hands."

Culture of rape-ſeed in Brabant.

Cole-ſeed is cultivated in Brabant in the following manner, according to the Abbe Mann. "It is ſown about the middle of July, and the young plants are tranſplanted about the end of September. This is done with a narrow ſpade ſunk into the ground, and moved with the hand forwards and backwards; which ſimple motion makes a ſufficient opening to receive the plant; a boy or a girl follows the labourer with plants, and putting one of them into each hole, treads againſt it to cloſe it up. If the plantation is done with the plough, the plants are placed at regular diſtances in the furrow, and are covered with the earth turned up with the ſucceeding furrow. Sometimes, after the cole-ſeed is planted, the foot of the ſtalks is covered, by means of a common ſpade or hoe, with the earth near it, which furniſhes nouriſhment for the plants during winter, by the crumbling of theſe little clods of earth over the roots. The cole-ſeed is reaped about midſummer or later, according as the ſeaſon is more or leſs advanced; it is left on the field for ten or twelve days after it is cut, and then thraſhed on a kind of ſail-cloth, ſpread on the ground for that purpoſe, and the ſeed carried in ſacks to the farm. When the crop is good, a bunder produces about forty raziers of 80lb. weight each. It is to be obſerved, that the ground whereon cole-ſeed is to be planted, muſt be dunged and twice ploughed the ſame year it is put in uſe."

The

The cultivation of cole-ſeed in Flanders is thus deſcribed by Mr Young: "Near this town (Cambray) I met firſt with the culture of cole-ſeed; they call it *goſa*. Sow the ſeed thick on a ſeed-bed for tranſplanting, ſetting it out on an oat ſtubble after one ploughing. This is ſo great and ſtriking an improvement of our culture of the ſame plant, that it merits the utmoſt attention; for ſaving a whole year is an object of the firſt conſequence. The tranſplanting is not performed till October, and laſts all November, if no froſt; and at ſuch a ſeaſon there is no danger of the plants not ſucceeding: earlier would, however, ſurely be better, to enable them to be ſtronger rooted to withſtand the ſpring froſts, which often deſtroy them; but the object is not to give their attention to this buſineſs till every thing that concerns wheat-ſowing is over. The plants are large, and two feet long; a man makes the holes with a large dibble, like the potato one uſed on the Eſſex ſide of London, and men and women fix the plants at 18 inches by 10 inches; ſome at a foot ſquare; for which they are paid nine livres per manco of land. The culture is ſo common all the way to Valenciennes, that there are pieces of two, three, and four, acres of ſeed-bed now cleared or clearing for planting." Rape or Cole-Seed.

Coriander-Seed.

SECT. III.

CORIANDER-SEED, CARAWAY, &c.

THIS is uſed in large quantities by diſtillers, druggiſts, and confectioners; and might be a conſiderable object to ſuch farmers as live in the neighbourhood of great towns: but the price is very variable; viz. from 16s. to 42s. per cwt. In the 4th volume of the Bath Papers, Mr Bartley gives an account of an experiment made on this ſeed, which proved very ſucceſsful. Ten perches of good ſandy loam were ſown with coriander on the 23d of March 1783. Three pounds of ſeed were ſufficient for this ſpot; and the whole expence amounted only to 5s. 10d. The produce was 87 pounds of ſeed, which, valued at 3d. yielded a profit of 5s. 11d. or 15l. 18s. 4d. per acre. He afterwards made ſeveral other experiments on a larger ſcale; but none of the crops turned out ſo well, though all of them afforded a good profit.

Mr Bartley's experiment.

Coriander, caraway, and teaſel, mixed.

In the 21ſt volume of the Annals of Agriculture, the following deſcription is given by John Sewell, Eſq. of the mode of raiſing a mixed crop of coriander, caraway, and teaſel. "About the beginning of March plough ſome old paſture land; if it has been paſture for a century the better, and the ſoil ſhould be very ſtrong clayey loam. Mix 12lb. of caraway, 10lb. of coriander, and 12lb. of teaſel ſeed, together, which is ſufficient for one acre; ſow directly after the plough, and dreſs, (I ſuppoſe *harrow*) the land well. When the plants

plants appear of ſufficient ſtrength to bear the hoe (which will not be until ten weeks after ſowing), it muſt not be omitted; and, in the courſe of the ſummer, it will require three hoeings, and one at Michaelmas; each will be about 8s. per acre. The coriander is annual, and is fit to cut about the beginning of July; ſhould be left in the field after cutting, and thraſhed on a cloth, in the ſame manner as rape-ſeed. About April following, your teaſel and caraway will want a good hoeing, done deep and well, and another hoeing about the beginning of June; theſe two hoeings are to be done at 7s. per acre each. The caraway will be fit to cut the beginning of July; and muſt be thraſhed in the ſame manner as coriander. The teaſel will not be ready till the middle of September, when thoſe heads which are beginning to turn brown are cut off the ſtem with a ſtalk a foot long, and 25 of them are tied in a bunch; 24 of the bunches are fixed on a ſmall ſtick, and called a *row*, 240 of which make a load in bulk, equal to a ton of hay for the meadow. The work of cutting and bunching the teaſel can only be done by thoſe who have been well acquainted with and learned the mode; it muſt be looked over, and the heads cut at ſeveral times as they ripen. The teaſel and caraway are perennial, and ſome of the plants do not perfect their ſeeds till the third or fourth year; though in general you have a crop the ſecond year, yet enough are left for a crop the third year, and the ſeeds that are ſcattered from the crop the ſecond year often come to perfection the fourth year; ſo that I have known inſtances of its being continued for ſeven years. The uſual way is to plough directly after the crop is gathered the third year, and ſow wheat; of which commonly

Coriander-Seed.

Coriander-Seed.

a very good crop is obtained, the land being in fine order, from the turf being rotted and the repeated hoeings. The firſt appearance of teaſel, after ſowing, is much like a lettuce; coriander like a parſnip; and caraway exactly like carrots. The produce of caraway has often been on the very rich old leys, in the hundreds, or low lands, of this county, 20 cwt. per acre. There is always a demand for it in the London market, ſometimes ſo low as 12s. per cwt. and it has been up to 50s. per cwt. moſtly on an average at 21s. Coriander is alſo very productive on good land, often producing 24 cwt. per acre, ſometimes not more than 6 or 7 cwt.; the price being ſometimes 30s. per cwt; often as low as 10s.; average in general about 16s. London market. Teaſel is uſed only, among the manufacturers of ordinary cloth and baize, to raiſe the wool on them that covers the thread. As we have a large buſineſs of that kind carried on in this part of the country, we have a regular demand for teaſel; the average price about 12l. per load; the produce ſometimes a load per acre; often not more than one-fourth of a load. The land can only be filled with plants; and the more one kind predominates, the leſs muſt reaſonably be expected of the crop that ſucceeds. It is moſtly ſown on land ſo ſtrong as to require being a little exhauſted, to bring it fit for bearing corn. Moſt of the land is ſown with caraway and coriander; the teaſel is omitted as being a more troubleſome and uncertain crop; and generally the product of caraway is much greater without than with teaſel."

SECT.

Canary-Seed.

SECT. IV.

CANARY-SEED.

THIS is cultivated in large quantity in the Iſle of Thanet, where it is ſaid they have frequently 20 buſhels to an acre. Mr Bartley, in the month of March 1783, ſowed half an acre of ground, the ſoil a mixture of loam and clay; but had only eight buſhels and a half, or 17 buſhels per acre. With this produce, however, he had a profit of 4l. 2s. 3d. per acre. Culture of canary-ſeed.

SECT. V.

WOAD.

THE uſe of this in dyeing is well known; and the conſumption is ſo great, that the raiſing of the plant might undoubtedly be an object to a huſbandman, provided he could get it properly manufactured for the dyers, and could overcome their prejudices. At preſent the growing of this plant is in a manner monopolized by ſome people in particular places, particularly at Keynſham near Briſtol in England. Mr Bartley informs us, that in a converſation he had with theſe growers, the latter aſſerted, that the growth of woad was peculiar to their ſoil and ſituation. The ſoil about this place is a blackiſh heavy mould, with a conſiderable Woad eaſily cultivated.

Woad. able proportion of clay, but works freely: that of Briſlington, where Mr Bartley reſides, a hazel ſandy loam; nevertheleſs, having ſowed half an acre of this ſoil with woad-ſeed, it throve ſo well, that he never ſaw a better crop at Keynſham. Having no apparatus, however, or knowledge of the manufacture, he ſuffered it to run to ſeed, learning only from the experiment, that woad is very eaſily cultivated, and that the only difficulty is the preparing it for the market.

SECT. VI.

HOPS.

Hops forbid by act of parliament.

THE uſes of theſe, as an ingredient in malt liquors, are well known. Formerly, however, they were ſuppoſed to poſſeſs ſuch deleterious qualities, that the uſe of them was forbid by act of parliament in the reign of James VI. But though this act was never repealed, it does not appear that much regard was ever paid to it, as the uſe of hops was ſtill continued, and is found not to be attended with any bad effect on the human conſtitution. The only queſtion, therefore, is, How far the raiſing a crop of them may be profitable to the huſbandman? and indeed this ſeems to be very doubtful.

Mr Arthur Young, in a Fortnight's Tour through Kent and Eſſex, informs us*, that at Caſtle Hedingham he

* *Annals of Agriculture*, vol. ii.

he was told by a Mr Rogers, who had a conſiderable hop-plantation, that four acres of hop-ground coſt him upwards of 120l. and that the uſual expences of laying out an acre of ground in this way amounted to 34l. 6s. By a calculation of the expences of an acre in Kent, it appeared that the money ſunk to plant an acre there amounted to 32l. 8s. 6.; that the annual expence was 23l. and the profit no more that 1l. 8s. 1d. In another place, he was informed by a Mr Potter, who cultivated great quantities of hops, that if it were not for ſome extraordinary crops which occurred now and then, nobody would plant them. In Eſſex, the expences of a hop-plantation are ſtill greater than thoſe we have yet mentioned; an acre many years ago requiring 75l. to lay it out in hops, and now not leſs than 100l. the annual expence being eſtimated at 31l. 1s. while the produce commonly does not exceed 32l.

Hops. Expence of cultivating them at Caſtle Hedingham. In Eſſex.

In the neighbourhood of Stow-market in this county, Mr Young informs us, there are about 200 acres planted with hops, but "18 or 20 are grubbed up within two years, owing to the badneſs of the times." Here they are planted on a black looſe moor, very wet and boggy; and the more wet the better for the crop, eſpecially if the gravel, which conſtitutes the bottom, be not more than three feet from the ſurface. In preparing the ground for hops, it is formed into beds, 16 feet wide, ſeparated from each other by trenches. In theſe beds they make holes ſix feet aſunder, and about 12 inches diameter, three rows upon a bed. Into each hole they put about half a peck of very rotten dung or rich compoſt, ſcatter earth upon it, and plant ſeven ſets in each; drawing earth

enough

Hops. enough to them afterwards to form ſomething of a hillock. A hop-garden, Mr Young informs us, "will laſt almoſt for ever, by renewing the hills that fail, to to the amount of about a ſcore annually, but it is reckoned better to grub up and new-plant it every 20 or 25 years."

Profit of breaking up hop-land precarious. In this volume of the Annals, Mr Young informs us, that "one profit of hop-land is that of breaking it up. Mr Potter grubbed up one garden, which failing, he ploughed and ſowed barley, the crop greater then mazagan beans, two acres of which produced 16 quarters and five buſhels. He then ſowed it with wheat, which produced 13 quarters and four buſhels and a half: but ſince that time the crops have not been greater than common. The ſame gentleman has had 10 quarters of oats after wheat." In the ninth volume of the ſame work, however, we have an account of an experiment by Mr Le Bland of Sittingbourn in Kent, of grubbing up twelve acres of hop-ground, which was not attended with any remarkable ſucceſs. Part of the hops were grubbed up in the year 1781, and mazagan beans ſown in their ſtead: but by reaſon of the ſeed being bad, and the dry ſummer, the crop turned out very indifferent. Next year the remainder of the hops were grubbed up, and the whole 12 acres ſown with wheat; but ſtill the crop turned out very bad, owing to the *wet* ſummer of that year. It was next planted with potatoes, which turned out well: and ever ſince that time the crops have been good. This gentleman informs us, that the perſon who had the hop-ground above-mentioned did not loſe leſs by it than 1500l.

The

The culture of hops ſeems to be confined in a great meaſure to the ſouthern counties of England; for Mr Marſhal mentions it as a matter of ſurpriſe, that in Norfolk he ſaw a "tolerably large hop-garden." The proprietor informed him, that three or four years before there had been 10 acres of hops in the pariſh (Blowfield) where he reſided; which was more than could be collected in all the reſt of the county; but at that time there were not above five: and the culture was daily declining, as the crops, owing to the low price of the commodity, did not defray the expence. Hops. Culture of hops in Norfolk on the decline.

From all this it appears, that hops are perhaps the moſt uncertain and precarious crop on which the huſbandman can beſtow his labour. Mr Young is of opinion, that ſome improvement in the culture is neceſſary; but he does not mention any, excepting that of planting them in eſpaliers. This method was recommended both by Mr Rogers and Mr Potter above mentioned. The former took the hint from obſerving, that a plant which had been blown down, and afterwards ſhot out horizontally, always produced a greater quantity than thoſe which grew upright. He alſo remarks, that hops which are late picked carry more next year than ſuch as are picked early; for which reaſon he recommends the late picking. The only reaſon for picking early is, that the hops appear much more beautiful than the others.

SECT.

White Beet.

SECT. VII.

WHITE BEET.

When treating of plants cultivated for their roots, we took notice of the beet or root of ſcarcity. We account it neceſſary, however, to reſume the ſubject in this part of the work, in conſequence of an attempt now making in the northern parts of the continent of Europe, to render the cultivation of this root the means of producing one of the moſt valuable articles of commerce, which has hitherto been regarded as peculiarly appropriated to the more fertile regions of the torrid zone. It appears, that after labouring many years upon the ſubject, F. C. Achard, director of the phyſical claſs in the Royal Academy of Sciences at Berlin, has publiſhed an account of a mode of cultivating the white beet ſo as to render it capable of producing large quantities of the fineſt ſugar; the proceſs for extracting it, in a cheap and eaſy manner, he has deſcribed. The king of Pruſſia has given great encouragement to the plan, which is ſaid to have been purſued with ſucceſs by various perſons. The emperor of Ruſſia is endeavouring to introduce it into his dominions; and it has engaged the attention of the men of letters and the government of France. As the climate of Pruſſia, where this diſcovery is ſaid to have been made, is not better than our own, and as the ſoil is inferior, there is no doubt, that, if the diſcovery ſhall ultimately prove even of much leſs value than it has been repreſented, a conſiderable

ſiderable change will be produced by means of it in the objects of European agriculture: and the inhabitants of the temperate climates will ceaſe to be dependant for what is now almoſt one of the neceſſaries of life, upon induſtry exerted in the unhealthy regions between the tropics. Either in this point of view, or as a matter of agricultural curioſity, we ſhall ſtate to our readers the nature of the diſcovery in queſtion; and that we may do it the more juſtice, we ſhall give it in the words of the inventor himſelf. White Beet.

"In the courſe of ſeveral years paſt (ſays M. Achard), I have made experiments to aſcertain how far various native plants might be fit for making ſugar. In theſe inquiries I had the opportunity of obſerving, that the quantity of ſaccharine matter, and its proportion to the other conſtituent parts of the ſame ſpecies of plants, may be increaſed or diminiſhed by the manner of cultivation.

2. "Among the various plants which I examined for the purpoſe of making ſugar in this country, I paid particular attention to the ſeveral ſpecies of *beta vulgaris Linnæi*; one of which, peculiarly proper for manufacturing ſugar, is known to the economiſt in this country by the name of *runkelruhe* *; and to the gardener, more eſpecially, by the name of *mangoldruhe*. On comparing the ſeveral varieties of this kind of plants, I was convinced, that the particular variety poſſeſſed of a *long conical root*,

* Bechmann deſcribes the white beet in the following manner: *Beta altiſſima, floribus ternis vel quaternis, foliolis calycis inermibus carinatis, caule craſſiſſimo faciato, radice maxima rubro et albo intus variegata, foliis maximis rubentibus.*

White Beet. *root, red rind, and the interior part white,* was the moſt abundant in ſugar; and that the ſaccharine contents of this variety of the *beta vulgaris,* called *runkelruhe,* may be greatly augmented or diminiſhed, according to the various methods of cultivating it.

3. " Having treated this root by various methods of culture, I obtained ſugar from it with more or leſs profit; in ſome inſtances with loſs, or even no ſugar at all, but frequently a mere extract in the form of a pulp, ſmelling like turnip; in which, from the exceſs of extractive matter, no ſugar could cryſtallize, unleſs ſome expenſive artificial expedients, not applicable in the large way, had been employed. Theſe obſervations have convinced me of the great influence of cultivation on the ſaccharine contents; and I ſpared no induſtry it order to diſcover the management by which this root might be cultivated of the greateſt richneſs in ſugar. I have not only raiſed them under various ſituations on my eſtate, French Buckholtz, but have procured ſuch roots from various other territories, as from Magdeburgh, Halberſtadt, Brunſwick, Blankenburgh, Ciecſar, and Nauen, with accounts of the methods by which they were cultivated.

4. " I then compared the reſults of the experiments which I had inſtituted for the purpoſe of obtaining ſugar, partly from roots of my own in different circumſtances of growth, and partly from thoſe of other folk, which were likewiſe differently cultivated. By this means I have found that the ſaccharine matter of this root may be conſiderably increaſed, and the extractive matter conſiderably diminiſhed. The conditions are,

(*a*) That it ſhould be cultivated in a rich ſoil, which will be beſt adapted to it if it be rather compact.

(*b*) " The

(*b*) "The ſeed is not to be ſown in one bed and the plants afterwards removed to another, as is commonly done; but, on the contrary, they muſt be ſuffered to ripen on the ſpot in which they germinate from their ſeeds. White beet.

(*c*) "The roots muſt not be too diſtant from each other. In the beſt ſoil their mutual diſtance ſhould be one foot; in a poorer ſoil, ſtill nearer, nine inches at moſt.

(*d*) "After they have ſprouted, they muſt be cleared of the weeds, either by the hoe or by pulling: taking care, when the hoe is uſed, that the earth be not removed from the plant, but rather, though ſlightly, brought nearer to it. This is not neceſſary when the weeds are pulled up. It is uſual to remove the earth from the plant when it is cultivated to ſerve as food for cattle; for its upper part is, by this management, greatly enlarged, and it acquires a greater maſs in the whole; but ſuch management is highly detrimental to the runkelruhe intended for making ſugar.

(*e*) "The leaves muſt not be taken off from the plant, as is the cuſtom, for the purpoſe of feeding cattle. This treatment diminiſhes the ſaccharine matter of the root, at the ſame time that it increaſes its mucilaginous, earthy, and farinaceous parts; and conſequently is very injurious to the quality of the root, if appropriated for making ſugar."

5. "On theſe five poſitions, which are grounded on repeated experiments and obſervations I can with juſtice and truth inſiſt; and that, with reſpect to the manufactory of native ſugar, if carried on with profit from the runkelruhe, every thing depends on its proper culture. For it is by this means only that the in- The quantity of ſugar depends on the culture.

White Beet. creaſe of its ſaccharine contents can be promoted; and it is only from the quantity of this laſt product, that ſugar can be made with profit from that root in the large way.

Cheap ſugar produced.

"That this root contains ſugar, has been long ſince proved by my celebrated predeceſſor in the Royal Academy of Sciences, the late director, Margraaf. But it was then unknown and unſuſpected that it could be obtained from it in the large way, and ſo cheap as *two groſhes* (about three pence Engliſh) for the pound of cryſtalline raw ſugar; and in ſome trials ſtill cheaper, as I have demonſtrated to be practicable, by the experiments made in preſence of the committee ſelected for that purpoſe by the king's command. This reſult is different from all trials hitherto made, in this reſpect, by the moſt able chemiſts. The cauſe is ſimply, that the great influence which the culture of the runkelruhe has, with regard to the increaſe of its ſugar, has not been ſuſpected; and that the different modifications of that culture were unknown; though, in fact, the quantity of ſaccharine matter may, on the one hand, be highly augmented, while, on the other hand, the proportion of thoſe conſtituent parts, which prevent the ſeparation of the ſugar, are greatly diminiſhed.

6. "From the method before deſcribed of producing the runkelruhe abundant in ſugar, by means of a proper cultivation, and from my other obſervations on the moſt profitable management of this root, the following inſtructions may be taken for its cultivation.

Soil to be preferred.

"A ſoil upon which wheat has grown is to be choſen, and kept in good condition. A low ſituation, not expoſed to great or laſting drought, yet without being moiſt or ſwampy, is to be preferred. It is better if ma-

nured

nured the year before than recently; which, however, must be done, if the former manuring has been omitted. This ground is to be ploughed thrice over, and as deep as the nature of the soil will admit. It is also very advantageous to perform, if possible, the first tillage in autumn. Immediately after the third ploughing, which should be done in the middle of April, or, at latest, about the middle of May; the ground is to be smoothed by the harrow as much as possible; and by means of a rake, whose teeth are distant from 9 to 12 inches, lines are to be traced along the surface, and by drawing the rake in lines across these, the ground becomes divided into squares, measured by the distance of the rake's teeth.

White Bee

Culture detailed.

7. "Into each intersected part of the lines delineated by the rake, one single seed capsule, if you are convinced of its good quality, is to be stuck in. But if not, then two such capsules are to be put in; and in either case to the depth of an inch. This operation may be done by children or inferior labourers. When the plants have germinated out of the ground, and six or eight leaves are formed, the weeds must be pulled up; but as I have already observed, the removal of the earth from the plant is to be very carefully avoided. It answers better to push the earth nearer to the plant, though this may be neglected without any bad consequence. At this period of the culture there is another operation to be performed. If the plants be too much accumulated on a particular spot, which is often the case, when very good seed has been used, because one capsule contains several seed grains, and produces more plants than one on the same spot; in this case the superabundant plants are to be pulled out.

White Beet. 8. "There is no occaſion for this operation, if the the ſeed has not been quite freſh or not quite ripe. But in caſe ſome empty places ſhould be found where nothing has grown up, two freſh grains ſhould be inſerted. After the ground has been once cleared of the weeds, the plants grow up ſo ſpeedily, that their leaves ſoon completely cover the ground, and thus abſolutely prevent the growing of any more weeds. In conſequence of this, and to the great advantage of the farmer, an acre of ground cultivated with runkelruhe occaſions no more trouble till the time of gathering; which circumſtance greatly facilitates their cultivation, becauſe the time of the cultivator, who is then buſied in his corn harveſt, is not required to be at all employed on this object: for the gathering of theſe roots begins only towards the end of September, and may be continued to the end of October, if no early froſt ſets in.

9. "At this gathering nothing particularly remarkable occurs, except that the root muſt be as little injured as poſſible; partly to prevent the loſs of its juice, and partly to prevent the decay to which the wounded parts are more expoſed than the ſound ones. The verdure muſt be then cut off in ſuch a manner, that the *heart* be alſo ſeparated, in order to prevent the germination of the root. Too much, however, ſhould not be lopped off the head, becauſe the juice would, in that caſe, too plentifully exſude. Theſe leaves and hearts are exceedingly valuable to the farmer at this time, when other green food for his cattle is wanting.

10. "The roots may be kept for uſe in ditches dug in the earth, where the depth, the dryneſs, and the looſe nature of the ſoil admit of it. Where this is not practicable, on account of the moiſtneſs and firmneſs of the

ſoil,

ſoil, they may be preſerved and ſecured againſt the froſt in cellars. But the heart muſt not be taken out nor injured in ſuch roots as are kept during the winter, in order to obtain ſeed from them by tranſplantation in the ſpring. The leaves are merely to be broken off. The roots muſt be well covered during winter, and ſheltered againſt froſt. In general, in the production of the ſeed from the runkelruhe, the ſame method is to be uſed as with other biennial roots and ſpecies of cole. As this procedure is known to every economiſt and gardener, I ſhall loſe no time by deſcribing it.

11. When large diſtricts of ground are to be cultivated with this plant, the ſeed capſules cannot, for want of time, be ſingly put into the ground. The ſeed muſt, therefore, be ſown with the greateſt poſſible uniformity. The Magdeburg acre will require from three to four pounds of ſeeds, according to the quality of the ſoil. If the ſowing has been well performed, the plants will be diſtant nine inches or a foot at moſt; in caſe the roots grow nearer to each other, they do not contain leſs ſugar on this account, but they remain ſmall. If too far aſunder, they grow larger, but abound leſs in ſugar. It is, therefore, leſs detrimental to ſow too thick than too ſparingly.

12. "It has before been remarked, that the practice of pulling the leaves from the plant ought to be carefully avoided; but this obſervation relates only to the green vegetating leaves. The under leaves frequently turn yellow and die, and, in theſe circumſtances of decay, they may be taken off, and will afford the farmer ſome aſſiſtance in a ſcarcity of food, without injury to the culture of our root.

13. "Reſpecting the choice of the ſeed, beſides its

early and perfect ripening, regard muſt be had, that it be not obtained from roots, which, after their germination, have been tranſplanted on ſeed-beds; but from ſuch as remained on the ſpot where they grew from the capſules till autumn, and which likewiſe have produced the true oblong, thin, conical roots. This is neceſſary, becauſe ſuch a ſeed, from untranſplanted plants, produces roots more partaking of the ſpindle form; whereas the ſeeds from the tranſplanted roots form thicker, and at the ſame time ſhorter, and on the lower parts roundiſhly terminated roots. The art of gardening affords numerous inſtances of the effect of this management. The ſeeds obtained from untranſplanted lettuce yield, on being ſown, plants which but extremely ſeldom form any heads, and never obtain any firmneſs. The ſeed of a looſe and not tranſplanted cabbage never produces white cabbage, but a looſe cole, not ſhooting into a head. The ſeed of celery, if procured not from a plant which, by tranſplantation, has been formed into a knob or nodule, but from celery which, for want of tranſplantation, has produced rather fibrous roots, yields on being ſown only herb, and no nodules. I am convinced of the truth of theſe aſſertions from my own experiments, and appeal to what Luder and Germerſhauſen have written on this ſubject, as men whoſe ſcience and accuracy will not be diſputed.

14. "Among the ſpindle-ſhaped runkelruhes there exiſts a variety, as to their colour. Some have a pale-red rind, and are internally *quite white*; others with a rind uſually of a more deep red, are internally *ſtriped reddiſh*; others again, of a more or leſs deep red, have *red circles*; and laſtly, there are ſome which, with an almoſt *white rind*, have the internal part *yellow*. Thoſe which

which are white, with a light red rind, deſerve the preference beyond all others: for they yield much ſugar, and an agreeable ſweet ſyrup; which, if well prepared, has no taſte of the root.

15. "The red-ſtriped or circled roots, whoſe rind alſo is always of a darker colour, afford ſugar indeed, but the ſyrup is bad on account of its taſte of the root, which cannot be removed, but by expenſive chemical proceſs. The runkelruhes of a white rind and yellow internal part do certainly afford much ſugar, which ſhoots very readily into large cryſtals; but their ſyrup being of an extremely diſguſting taſte is of no uſe, when raw ſugar only is made. Even the ſugar itſelf prepared from theſe roots is not eaſily, but with difficulty, cleared of that taſte in the condition of raw ſugar, though it certainly diſappears in refining. For this reaſon this laſt variety of the runkelruhe that contains ſo much ſugar is not to be totally rejected, but is rather profitable in the manufactory of ſugar: more eſpecially, if not intended to be employed as raw ſugar, and if the acquiſition of the ſyrup be diſregarded.

16. "It is ſufficiently proved from the phyſiology of plants, that the *matter of light* has a great ſhare in the formation of ſome of their conſtituent parts, as to quality, and conſequently on their mutual proportions."

Mr Achard proceeds with the prolixity uſual among German writers who leave nothing to be ſupplied by reflection, obſervation, or previous knowledge of their readers, to prove that the admiſſion of light deprives the roots of vegetables of a ſaccharine quality, though it has a different effect upon fruits at the tops of trees or other plants. He remarks, that the roots of aſpara-

White Beet. gus, hops, liquorice, and cucumber, are ſweet while covered with earth, but on ſprouting above ground, they acquire the peculiar ſharp taſte of the plant, and that carrots are always ſweeteſt when ſown between hemp and poppies, or when ſhaded by any other overhanging vegetables. He recapitulates the principles on which the new mode of cultivation proceeds in theſe terms:

Principles of the new culture. "In my method of cultivation, the ground is wholly covered with leaves, and conſequently ſhaded by reaſon of the nearneſs of the plants to each other; but, on the contrary, thoſe roots which have been cultivated to feed cattle, are ſown or planted at a much greater and uſually double that diſtance. This very neceſſary adumbration is maintained by taking care not to cut the leaves till the roots themſelves are gathered. The acceſs of light to the ſurface of the field, to the great injury of the formation and accumulation of the ſaccharine matter in the root, is not the only bad conſequence: there is another noxious effect; namely, that it promotes the drying of the ground in hot ſeaſons, which is always very detrimental. Moreover, the natural growth of the roots is, by this means, neceſſarily diſturbed, and cannot be productive of good conſequences. Again, if the earth be not removed from the plant, the action of light on the top of the root is checked; and the ſeparation of the ground, which is done in many places, tends only to increaſe the ſize of the root. Laſtly, By producing the roots from ſeed, which has been ſown on the ſpot where the plant is to remain, this advantage is obtained, that the root acquires a ſpindle-ſhape, penetrates deeper into the ground, and therefore acquires more ſweetneſs; for it is always ſweeter in the lower than in the

the upper part. To conclude, the projection of one part of the root out of the ground, which obtains in the growth of almoſt all roots, and eſpecially of the runkel-ruhe, is by this method prevented. The cauſe of this prominence conſiſts in this; that the earth, which it is impoſſible to avoid, is looſened on the ſpot where the plant is inſerted. It ſinks again on becoming firm, and hence the upper part of the root becomes prominent. Another, and the principal cauſe of this effect, ariſes from the circumſtance that, on tranſplanting the plant, either the point of the root is taken off, or, on account of its tenderneſs, unintentionally injured; nor does it again acquire an upright poſition: ſo that, for all theſe reaſons, it cannot proceed in growing downwards perpendicularly. Whence the root does not continue in the ſlender conical form which it had, and would have preſerved, if it had not been tranſplanted: it then forms a more roundiſh and nodular root, which, in the progreſs of its vegetation (not being able to ſpread downwards from the too great reſiſtance of the ſoil) riſes upwards, and protuberates more or leſs from the earth in proportion to its ſtronger or weaker growth. Thus circumſtanced, the prominent part becomes ſo modified in its conſtituent parts by the action of light, that it not only yields leſs of ſugar, but alſo adulterates the ſaccharine matter, copiouſly contained in the lower part, with ſo many noxious principles, that the preparation of ſugar from the root is rendered very difficult, and ſometimes even impoſſible."

White beet.

The mode of preparing the ſugar is thus deſcribed: "It is aſcertained from the operation of extracting ſugar from the beet root, which I have performed under the inſpection of a committee nominated by the king of

Mode of preparing ſugar from the beet.

White Beet. of Pruſſia, that the beſt method is as follows: The root, not peeled, but in the ſtate in which it is dug out of the ground, with no other preparation than that of carefully ſeparating the leaves and the heart, is to be boiled in water till it is ſoft enough to be pierced with a ſtraw. A ſhort time of ebullition is ſufficient to give it this degree of ſoftneſs, which is well known to the confectioners, who give it to ſome fruits before they preſerve them. The beet, when cold, is divided and reduced into ſlices by means of the machine uſed by farmers to ſlice potatoes for cattle. A deſcription of this machine is to be found in a publication of Buch, entitled *Neberfecht der fortſchritte in Wiſſenſchaften, Kunſten, Manufacturer and Handwerhen Von Oſtern* 1796; *bis Oſtern* 1797; *Erfurt* 1798; and the engraving which renders the ſubject clearer, is copied in the firſt plate of my work. This method of dividing the root is the beſt I have yet found. Two men, with this machine, can cut nearly 100 pounds into very fine ſlices in three minutes. To extract the juice from the roots, when ſliced, they are ſubjected to the action of a preſs which ſhould act with force ſufficient to extract at firſt as much juice as poſſible. The pulp which remains in the preſs, ſtill contains a conſiderable portion of ſugar which is worth extracting. To effect this it is diluted in a ſufficient quantity of water for 12 hours, after which the fluid part is drawn out by preſſure. The ſaccharine matter, after this ſecond extraction, is ſtill ſufficiently abundant to afford, by fermentation, brandy or vinegar with profit.

"The liquids thus obtained are afterwards mixed and ſtrained through a flannel, and reduced by conſtant boiling to about two thirds. It is then paſſed a ſecond time

time through a woollen cloth, or a piece of cloth, ſuch as is uſed in ſugar refineries; after which the liquor is boiled in a ſmaller veſſel than the firſt, till it is reduced to one half. The liquor is again boiled in a ſtill ſmaller veſſel, which gives it the conſiſtency of a liquid ſyrup. It is neceſſary to remark, that, by endeavouring to give to the ſyrup a too ſtrong conſiſtency, there will be danger of ſpoiling the whole.

"This ſyrup poured into ſhallow earthen veſſels, which preſent a large ſurface to the air, is to be placed in a ſtove at the heat of 20 or 30 degrees, or if agreeable at 30 or 40 of Reaumur, in order to cryſtallize it. During this inſenſible condenſation of the ſyrup the cryſtalline incruſtation, which is formed at the ſurface, ſhould be occaſionally broken, in order that, by favouring the evaporation, the product of cryſtals may be haſtened. As ſoon as it is obſerved, that inſtead of the cryſtalline incruſtation a thick gummy pellicle, not granulated, is formed on the ſurface of the ſyrup, it is a ſign that the matter does no longer cryſtallize but begin to dry, and the evaporation ſhould then be ſtopped. This reſidue forms a mixture more or leſs thick, of a cryſtalline ſubſtance and a fluid viſcid matter. In order to ſeparate the cryſtalline ſugar from the gummy extract, they are put together into a ſack of wet cloth tied tight, and then by means of a preſs, gradually applied, the fluid part is to be paſſed through the cloth, and the ſugar remains in the bag. This ſugar, after drying, is a yellow muſcovade, compoſed of regular cryſtals, which, when pulverized, form a white powder; of which the taſte is very good, being ſweet and clear, and may be applied to a number of uſes for which refined ſugar is employed. By the operation of refining, ſugar may be made

White Beet. made from this muſcovado of whatever quality is agreeable, and, by repeating it, the fineſt ſugar may be had. The waſte in this manufacture, that is to ſay, the reſidual pulp, the ſyrup or mucilage, which paſſes through the cloth when ſubjected to the preſs, the ſyrup in which the ſugar has cryſtallized, the waſhings, &c. all theſe are ſtill very uſeful; and a conſiderable quantity of rum or brandy may be obtained from them, which may be uſed in making up the fineſt compounds. The muſcovado, ſuch as is obtained by the firſt operation, coſts about a groſs and a half of Pruſſia, without reckoning the matter which may be had by turning the reſidues to uſe. When we add this product, and when the manipulations ſhall be more perfect, to effect which I ſhall employ myſelf this winter, I am perſuaded that our European muſcovado will only coſt half the price, or nine fennins; and in the countries where fuel is dearer, one groſs (about 2½d) per pound avoirdupois. The manufacture of ſpirits from the waſte of the ſugar is of great importance, as by this means a great ſaving of corn will be made, and the manufacturing of beet-ſugar, which delivers Europe from a deſtructive monopoly, becomes ſtill more intereſting. I am at preſent employed in the attempt to diſcover a method of pouring the juice of the roots, when ſufficiently condenſed, into moulds or forms in order that it may acquire the figure of a ſugar-loaf, and afterwards by claying become very white at a ſingle operation. I have already found ſeveral methods of obtaining this object very ſpeedily. This new manipulation will facilitate the art of ſugar-making, and diminiſh the price ſtill further."

It is to be obſerved, that a committee of the claſs

of

of mathematical and phyſical ſciences of the national inſtitute of France was appointed to repeat the experiments of Mr Achard on the ſugar of the beet root. This committee began their experiments, by digeſting a quantity of dried beet root in rectified ſpirit of wine, which they afterwards decanted off. They next evaporated the ſpirit of wine, and thus obtained the ſugar diſſolved in it. This ſugar amounted to one-ſixteenth of the beet root that had been employed. They next boiled the beet root and expreſſed the juice, proceeding according to Mr Achard's directions. The reſult of their experiment was extremely unſucceſsful, as they obtained only a very ſmall quantity of ſugar. They afterwards extracted the juice of the root in its raw ſtate, and having evaporated this juice to the proper point, and kept it in a warm place for a month, they obtained a far larger quantity of ſugar. The concluſion of the whole after many trials was, that, upon a large ſcale, they found that 32,400 ſquare feet of ground cultivated with beet would produce 450 cwt. of the root. That this 450 cwt. of beet root would furniſh about 782 pounds of muſcovado ſugar; which, by the proceſs of refining, would be reduced to 448 libs of pure ſugar; and that on calculating the whole expences, this pure ſugar could not be ſold for leſs than 9d. per pound. Upon the whole, the committee conſidered Mr Achard's diſcovery as extremely important; but they conſidered the ſubject as not fully inveſtigated, becauſe the beet root on which their experiments were performed, had not been cultivated in Mr Achard's manner, but conſiſted only of ſuch as could be purchaſed in the neighbourhood of Paris. It may alſo be remarked, that the French chemiſts do not appear to have attended to certain

White Beet.

French experiments.

tain rules which Mr Achard repreſents as indiſpenſable in the proceſs of extracting the ſugar. Theſe rules are ſpecially mentioned in a letter from Mr Achard to Profeſſor Scherer, dated June 2. 1800. "The method which I have purſued is very ſimple, and attended with the leaſt expence. The beet roots are waſhed, and cut down raw with the potato machine; after which they are boiled ſoft in ſpring water, 10 quarts being ſufficient to boil a hundred weight of the roots. They are then preſſed out hot from the pan, and the juice which they yield is immediately put, whilſt hot, into the boiler, and boiled down to the conſiſtence of inferior ſyrup. The cryſtallization ſucceeds extremely well, provided this boiling is performed in a ſhort ſpace of time: the juice may be condenſed by the moſt violent boiling without ſuffering any injury, if only it is not continued for any conſiderable length of time; whilſt, on the contrary, the moſt gentle boiling, if long continued, renders the juice unſuſceptible of cryſtallization. The flatter, therefore, theſe boilers are, and the ſmaller the height of the column of liquid that is to be boiled down is, at firſt, the more certain we are of obtaining good cryſtallizable ſugar. By following the method of preſſing out the boiled roots whilſt hot, and boiling down the hot juice immediately, one is ſecured from all the conſequences of fermentation; and in order to prevent theſe from taking place, too great caution cannot be employed. In operations, on a ſmall ſcale, they may eaſily be prevented; but, in the large way, it will be far more difficult, unleſs we follow the above-mentioned method. A hundred weight of the firſt reſidue that remains, after the boiled roots have been preſſed out, yields between ſeven and eight quarts of ſpirits, of

equal

equal ſtrength with the malt ſpirits uſually ſold, and is therefore equal in value to half a buſhel of wheat employed for this purpoſe. That the whole advantage reſulting from the manufacture of ſugar from the beet root depends entirely upon the manner of cultivation, and the choice of the beſt varieties of this plant, will again be proved, beyond all poſſibility of doubt, by the experiments made during the courſe of the preſent year, under the inſpection of his Pruſſian majeſty's commiſſioners."

We ſhall conclude theſe remarks by obſerving, that in the N° for January 1800 of Mr Nicholſon's Journal of Natural Philoſophy, Chemiſtry, and Arts, publiſhed in London, the following information is given by the editor: "Mr Accam has preſented me with ſamples of this ſugar received from Berlin, where I underſtand it is now very commonly manufactured. The written account of the culture, produce, and cheapneſs, received at the ſame time, appearing to want ſome corrections, I ſhall only ſtate at preſent, that the ſamples were, 1. A brown, or pale ſtraw-coloured ſugar, in lumps or agglutinated grains, forming a coarſe dry powder. It is not very ſweet, and has a peculiar, though not ſtrong ſmell, which I think reſembles that of ſome articles of confectionary conſiſting of ſugar and flour heated or fried together. Of this ſugar the beet is ſtated to afford five *per cent.* of its weight, leaving a pulp which is an excellent food for cattle. 2. A refined ſugar, in very ſmall cryſtalline grains, forming a powder of which the particles are lightly diſpoſed to adhere, and which, when laid upon writing paper, has very nearly the ſame whiteneſs. I could not aſcertain the figure of any of the grains under a deep magnifier, as moſt of them ſeem

Specimens ſent to London.

to

White Beet. to be partly rounded. It has no foreign ſmell or taſte. Equal weights of this and of good loaf ſugar were ſeparately diſſolved in equal weights of water; and ſix out of ſeven gentlemen who were preſent, and taſted the ſolutions, without knowing which was the beſt ſugar, determined, that the ſolution of this laſt was the ſweeteſt. I was among thoſe who thought ſo; but it appeared to me, that its flavour reſembled a coarſer ſugar than that againſt which it was tried. From this notion I afterwards took two wine glaſſes of water, and ſweetened the one with beet ſugar, and the other with loaf ſugar, with the addition of a ſmall proportion of fine moiſt ſugar. When the taſtes reſembled each other as nearly as I could bring them, I ſubmitted them to the judgment of the company preſent, who, from the irregularity of their conjectures, did not ſeem to find any notable difference. And when I myſelf again took up the glaſſes, without noticing the diſtinctive marks, and endeavoured by the taſte to determine which was the beet ſugar, it happened that I was miſtaken in my deciſion. This refined ſugar ſeems therefore to be of conſiderable purity and ſtrength. It is obtained from the other ſugar in the quantity of 55 *per cent.* together with 25 *per cent.* of reſidual ſyrup or molaſſes. 3. The other article was a bottle of this molaſſes. It is ſweet, with a ſingular vegetable flavour, rather fragrant; and would, I doubt not, afford either a pleaſant vinous liquor by fermentation, or a conſiderable quantity of ardent ſpirit."

SECT.

SECT. VIII.

CULTIVATION OF FRUIT.

In Herefordſhire and Glouceſterſhire the cultivation of fruit for the purpoſe of making a liquor from the juice, forms a principal part of their huſbandry. In Devonſhire alſo conſiderable quantities of this kind of liquor are made, though much leſs than in the two counties above mentioned.

Fruits cultivated in Herefordſhire and Glouceſterſhire.

The fruits cultivated in Herefordſhire and Glouceſterſhire are, the apple, the pear, and the cherry. From the two firſt are made the liquors named *cyder* and *perry*; but though it is probable, that a liquor of ſome value might be made from cherries alſo, it does not appear to have ever been attempted. Mr Marſhal remarks, that nature has furniſhed only one ſpecies of pears and apples; viz. the common crab of the woods and hedges, and the wild pear, which is likewiſe pretty common.

Varieties of fruits entirely artificial.

The varieties of theſe fruits are entirely artificial, being produced not by ſeed, but by a certain mode of culture; whence it is the buſineſs of thoſe who wiſh to improve fruits, therefore, to catch at ſuperior accidental varieties; and having raiſed them by cultivation to the higheſt perfection of which they are capable, to keep them in that ſtate by artificial propagation.

Varieties cannot be made permanent.

Mr Marſhal, however, obſerves, that it is impoſſible to make varieties of fruit altogether permanent, though their duration depends much upon management. "A time arrives (ſays he) when they can

Cultivation of Fruit.

no longer be propagated with ſucceſs. All the old fruits which raiſed the fame of the liquors of this country are now loſt, or ſo far on the decline as to be deemed irrecoverable. The *red-ſtreak* is given up; the celebrated *ſtir-apple*, is going off; and the *ſquaſh-pear*, which has probably furniſhed this country with more *champaign* than was ever imported into it, can no longer be got to flouriſh: the ſtocks canker, and are unproductive. In Yorkſhire ſimilar circumſtances have taken place: ſeveral old fruits which were productive within my own recollection are loſt; the ſtocks cankered, and the trees would no longer come to bear."

Our author controverts the common notion among orchard-men, that the decline of the old fruits is owing to a want of freſh grafts from abroad, particularly from Normandy, from whence it is ſuppoſed that apples were originally imported into this country. Mr Marſhal, however, thinks, that theſe original kinds have been long ſince loſt, and that the numerous varieties of which we are now poſſeſſed were raiſed from ſeed in this country. He alſo informs us, that at Ledbury he was ſhown a Normandy apple tree, which, with many others of the ſame kind, had been imported immediately from France. He found it, however, to be no other than the *bitter-ſweet*, which he had ſeen growing as a neglected wilding in an Engliſh hedge.

Mr Marſhal's directions for raiſing new varieties of fruit.

The proceſs of raiſing new varieties of apples according to Mr Marſhal, is ſimple and eaſy. "Elect (ſays he) among the native ſpecies individuals of the higheſt flavour; ſow the ſeeds in a highly enriched ſeed-bed. When new varieties, or the improvement of old ones, are the objects, it may perhaps be eligible to uſe a frame or ſtove; but where the preſervation of the ordinary

ordinary varieties only is wanted, an ordinary loamy ſoil will be ſufficient. At any rate, it ought to be perfectly clean at leaſt from root weeds, and ſhould be double dug from a foot to 18 inches deep. The ſurface being levelled and raked fine, the ſeeds ought to be ſcattered on about an inch aſunder, and covered about half an inch deep, with ſome of the fineſt mould previouſly raked off the bed for that purpoſe. During ſummer the the young plants ſhould be kept perfectly free from weeds, and may be taken up for tranſplantation the enſuing winter; or if not very thick in the ſeed-bed, they may remain in it till the ſecond winter. Cultivation of Fruit.

The nurſery ground ought alſo to be enriched, and double dug to the depth of 14 inches at leaſt; though 18 or 20 are preferable. The ſeedling plants ought to be ſorted agreeably to the ſtrength of their roots, that they may riſe evenly together. The top or downward roots ſhould be taken off, and the longer ſide rootlets ſhortened. The young trees ſhould then be planted in rows three feet aſunder, and from 15 to 18 inches diſtant in the rows; taking care not to cramp the roots, but to lead them evenly and horizontally among the mould. If they be intended merely for ſtocks to be grafted, they may remain in this ſituation until they be large enough to be planted out; though in ſtrict management, they ought to be re-tranſplanted two years before their being transferred into the orchard, "in freſh but unmanured double-dug ground, a quincunx four feet apart every way." In this ſecond tranſplantation, as well as in the firſt, the branches of the root ought not to be left too long, but to be ſhortened in ſuch a manner as to induce them to form a globular root, ſufficiently ſmall to be removed with the plant; Of the nurſery ground.

Cultivation of Fruit.

yet ſufficiently large to give it firmneſs and vigour in the plantation.

Method of chooſing the plants.

Having proceeded in this manner with the ſeed-bed, our author gives the following directions. "Select from among the ſeedlings the plants whoſe wood and leaves wear the moſt *apple-like* appearance. Tranſplant theſe into a rich deep ſoil in a genial ſituation, letting them remain in this nurſery until they begin to bear. With the ſeeds of the faireſt, richeſt, and beſt flavoured fruit repeat this proceſs; and at the ſame time, or in due ſeaſon, engraft the wood which produced this fruit on that of the richeſt, ſweeteſt, beſt-flavoured apple: repeating this operation, and transferring the ſubject under improvement from one tree and ſort to another, as richneſs, flavour, or firmneſs may require; continuing this double mode of improvement until the deſired fruit be obtained. There has, no doubt, been a period when the improvement of the apple and pear was attended to in this country; and ſhould not the ſame ſpirit of improvement revive, it is probable that the country will, in a courſe of years, be left deſtitute of valuable kinds of theſe two ſpecies of fruit; which, though they may, in ſome degree, be deemed objects of luxury, long cuſtom ſeems to have ranked among the neceſſaries of life."

The following mode of raiſing an orchard, together with the cyder fruits proper to be planted in it, is thus deſcribed, in a letter from the Rev. Charles Dunſter to the earl of Egremont *. "The mode of propagating the cyder fruit is (I believe conſtantly in Herefordſhire) by grafting.

* *Annals of Agriculture*, vol. xxxiii.

grafting. Very large and even old trees may be grafted, ſo as to bear very fine heads of other ſorts, and come to bear a crop of fruit as quick or quicker than by any other method. Where new orchards are to be raiſed, it is done by planting well-grown crabſtocks, and grafting them the year after. The mode of ſupplying you with Herefordſhire cyder fruits muſt therefore be, if you have any orchards, the fruit of which you ſet no value on, they muſt be grafted next ſpring; and I will take care that you ſhall be ſupplied with grafts from Herefordſhire.

Cultivation of Fruit.

Mode of raiſing cyder fruit.

"I ſhould obſerve to you, that if the trees are full-ſized, the tops of them muſt be cut off in the winter, otherwiſe, when grafted, they will *bleed* (as the term is), ſo much that the grafts will not ſucceed. The trees muſt not be cut down to the trunk, but as many branches muſt be left as look kind, above where it branches out, of the thickneſs of one's arm, or from that to twice as thick: the tops of theſe muſt be taken off about two or three feet from where they branch from the trunk. Theſe ſtubs will each bear two or three, or even four grafts, according to their ſize.

"I believe the ſkill of the grafter is material. The Herefordſhire farmers are very ſuperſtitious in this reſpect; and a man who is conſidered as a *lucky* graft will have the chief of the buſineſs for many miles round; though the operation ſeems ſo ſimple that it might be imagined almoſt all men would be, in this reſpect, to uſe the language of the times, *equal*.

"So much for grafting old orchards. For raiſing new ones, I could procure ſome good forward crabſtocks to be ſent in the beginning of March next, and planted immediately where they are meant to ſtand.

Cultivation of Fruit.

Theſe will coſt, according to their goodneſs, from 4d. to 1s. 6s. and 2s. a piece. They will be fit for grafting the very latter end of March, or beginning of April, the following year. Of theſe you might have a hundred or two hundred; and if you wiſh in future to enlarge your cyder plantation, you ſhould always be provided with crabſtocks in your own nurſery.

APPLES recommended, with their Qualities.

1. " *Foreſt Stire*—Famous ſtout cyder, and will grow from ſlips planted in the ground.
2. " *Cowarn Stire*—Recommended, and a kind growing tree.
3. " *Red Stire*—Stout round cyder.

Old, 4. " *Redſtreak*—Rich cyder; not propagated often with ſucceſs; apt to canker.

Old, 5. " *Woodcock*—Famous cyder; ditto, but grow ſome better; ditto.

Old, 6. " *Golden Pippen*—Ditto, ditto, ditto.

Old, 7. " *Red-ſided Muſk*—Ditto, ditto. } Theſe 2 ſorts grow
Old, 8. " *Yellow Elliot*—Ditto, ditto. } tolerably well.

Old, 9. " *Old Porſon*—Grows better than the above old fruits.

10. " *Royal Wilding*—Very rich cyder, and a faſt-growing tree; mixes well with ſtout cyder.
11. " *Cowarn Quining*—A pleaſant good cyder, and kind tree.
12. " *Red-ſided Norman*—Rich cyder, and faſt-growing tree, high coloured, and near in quality to the royal wilding.
13. " *Bennett Apple*—A very dry apple; ſtout good cyder, and a kind growing tree.

14. " *Garter Apple*—Recommended as famous, and making a good tree. Cultivation of Fruit.

15. " *Hagley Crab*—Stout famous cyder, and very growing tree.

16. " *Lawhorne Pearmain*—Recommended, and makes a kind tree.

17. " *Hagley Crab.*

Recommended to graft on old heads; the royal wilding, the redſided norman, cowarn quining, hagley crab, cowarn ſtire, or the lawhorne pearmain.

" There came two parcels named *hagley crab;* one, viz. N° 15. has yellow wood, moſt like a crab; the other, to which N° 17. is put, has dark wood, more like an apple."

In the fourth volume of Bath Papers, Mr Grimwood ſuppoſes the degeneracy of apples to be rather imaginary than real. He ſays, that the evil complained of " is not a real decline in the quality of the fruit, but in the tree; owing either to want of health, the ſeaſon, ſoil, mode of planting, or the ſtock they are grafted on, being too often raiſed from the ſeed of apples in the ſame place or county. I have not a doubt in my own mind, but that the trees which are grafted on the ſtocks raiſed from the apple pips are more tender than thoſe grafted on the real crab-ſtock; and the ſeaſons in this country have, for many years paſt, been unfavourable for fruits, which adds much to the ſuppoſed degeneracy of the apple. It is my opinion, that if planters of orchards would procure the trees grafted on real crab-ſtocks from a diſtant country, they would find their account in ſo doing much overbalance the extra expence of charge and carriage. Mr Grimwood's opinion of the degeneracy of apples.

In the ſame volume, Mr Edmund Gillingwater aſ- Mr Gillingwater's opinion.

Cultivation of Fruit.

ſigns as a reaſon for the degeneracy of apples the mixture of various farina, from the orchards being too near each other. In conſequence of this notion, he alſo thinks, that the old and beſt kinds of apple trees are not loſt, but only corrupted from being planted too near bad neighbours: "Remove them (ſays he) to a ſituation where they are not expoſed to this inconvenience, and they will immediately recover their former excellency." This theory, however, is not ſupported by a ſingle experiment.

Mr Samuel's opinion of the method of recovering the beſt fruit.

In this volume alſo Mr Richard Samuel expreſſes his concern at the "preſent neglect of orchards, where the old trees are decaying, without proper proviſion being made for the ſucceeding age: for if a farmer plants freſh trees (which does not frequently happen), there is ſeldom any care taken to propagate the better ſorts, as his grafts are uſually taken promiſcuouſly from any ordinary kind moſt eaſily procured in the neighbourhood." His remedy is to collect grafts from the beſt trees; by which means he ſuppoſes that the ſuperior kinds of fruit would ſoon be recovered. To a care of this kind he attributes the ſuperiority of the fruit in the neighbourhood of great towns to that in other places.

Cultivation, &c, of fruit trees.

With regard to the method of cultivating fruit trees, it is only neceſſary to add, that while they remain in the nurſery, the intervals betwixt them may be occupied by ſuch kitchen-ſtuff as will not crowd or overſhadow the plants; keeping the rows in the mean time perfectly free from weeds. In pruning them, the leader ſhould be particularly attended to. If they ſhoot double, the weaker of the contending branches ſhould be taken off; but if the leader be loſt, and not eaſily recoverable,

recoverable, the plant ſhould be cut down to within a hand's breadth of the ſoil, and a freſh ſtem trained. The undermoſt boughs ſhould be taken off by degrees, going over the plants every winter; but taking care to preſerve heads of ſufficient magnitude not to draw the ſtem up too tall, which would make them feeble in the lower part. The ſtems in Herefordſhire are trained to ſix feet high; but our author prefers ſeven, or even half a rod in height. A tall-ſtemmed tree is much leſs injurious to what grows below it than a low-headed one, which is itſelf in danger of being hurt, at the ſame time that it hurts the crop under it. The thickneſs of the ſtem ought to be in proportion to its height; for which reaſon a tall ſtock ought to remain longer in the nurſery than a low one. The uſual ſize at which they are p[illegible] in Herefordſhire is from four to ſix inches girt at three feet high; which ſize, with proper management, they will reach in ſeven or eight years. The price of theſe ſtocks in Herefordſhire is 1s. 6d. each. Our author met with one inſtance of crabſtocks being gathered in the woods with a good proſpect of ſucceſs. Cultivation of Fruit.

In Herefordſhire it is common to have the ground of the orchards in tillage, and in Glouceſterſhire in graſs; which Mr Marſhal ſuppoſes to be owing to the difference between the ſoil of the two counties; that of Herefordſhire being generally arable, and Glouceſter graſs land. Trees, however, are very deſtructive, not only to a crop of corn, but to clover and turnips; though tillage is favourable to fruit trees in general, eſpecially when young. In graſs grounds their progreſs is comparatively ſlow, for want of the earth being ſtirred about them, and by being injured by the cattle, eſpecially Method of managing the ground of orchards in Herefordſhire and Glouceſterſhire.

Cultivation of Fruit.

eſpecially when low-headed and drooping. After they begin to bear, cattle ought by all means to be kept away from them, as they not only deſtroy all the fruit within their reach, but the fruit itſelf is dangerous to the cattle, being apt to ſtick in their throats and choak them. Theſe inconveniences may be avoided, by eating the fruit grounds bare before the gathering ſeaſon, and keeping the boughs out of the way of the cattle; but Mr Marſhal is of opinion, that it is wrong to plant orchards in graſs land. "Let them (ſays he) lay their old orchards to graſs; and if they plant, break up their young orchards to arable. This will be changing the courſe of huſbandry, and be at once beneficial to the land and the trees.

Indolence of the farmers in theſe parts complained of.

Our author complains very much of the indolent and careleſs method in which the Herefordſhire and Glouceſterſhire farmers manage their orchards. The natural enemies of fruit trees (he ſays) are, 1. A redundancy of wood. 2. The miſletoe. 3. Moſs. 4. Spring froſts. 5. Blights. 6. Inſects. 7. An exceſs of fruit. 8. Old age.

Exceſs of wood how remedied.

1. A redundancy of wood is prejudicial, by reaſon of the barren branches depriving thoſe which bear fruit of the nouriſhment which ought to belong to them. A multitude of branches alſo gives the winds ſuch an additional power over the tree, that it is in perpetual danger of being overthrown by them: trees are likewiſe thus injured by the damps and want of circulation of air, ſo that only the outer branches are capable of bringing fruit to maturity. "It is no uncommon ſight (ſays he) to ſee trees in this diſtrict, with two or three tires of boughs preſſing down hard upon one another, with their twigs ſo intimately interwoven, that even

when

when the leaves are off, a ſmall bird can ſcarcely creep in among them. Cultivation of Fruit.

2. The miſletoe in this country is a great enemy to the apple tree. It is eaſily pulled out with hooks in froſty weather, when, being brittle, it readily breaks off from the branches. It likewiſe may be applied to a profitable purpoſe, ſheep being as fond of it as of ivy. Miſletoe how deſtroyed.

3. Moſs can only be got the better of by induſtry in clearing the trees of it; and in Kent there are people who make it their profeſſion to do ſo. Moſs on fruit trees.

4. Spring-froſts, eſpecially when they ſuddenly ſucceed rain, are great enemies to fruit trees; dry froſts only keep back the bloſſoms for ſome time. Art can give no farther aſſiſtance in this caſe than to keep the trees in a healthy and vigorous ſtate, ſo as to enable them to throw out a ſtrength of bud and bloſſom; and by keeping them thin of wood, to give them an opportunity of drying quickly before the froſt ſet it. Spring-froſts.

5. Blight is a term, as applied to fruit trees, which Mr Marſhal thinks is not underſtood. Two bearing years, he remarks, ſeldom come together; and he is of opinion, that it is the mere exhauſting of the trees by the quantity of fruit which they have carried one year, that prevents them from bearing any the next. The only thing therefore that can be done in this caſe is, to keep the trees in as healthy and vigorous a ſtate as poſſible. Blights an uncertain term.

6. Inſects deſtroy not only the bloſſoms and leaves, but ſome of them alſo the fruit, eſpecially pears. In the year 1783 much fruit was deſtroyed by waſps. Mr Marſhall adviſes to ſet a price upon the female waſps in the ſpring; by which theſe miſchievous inſects Method propoſed of deſtroying waſps.

Cultivation of Fruit.

fects would perhaps be exterminated, or at leaſt greatly leſſened.

Of an exceſs of fruit.

7. An exceſs of fruit ſtints the growth of young trees, and renders all in general barren for two or three years; while, in many caſes, the branches are broken off by the weight of the fruit; and, in one caſe, Mr Marſhal mentions, that an entire tree had ſunk under its burden. To prevent as much as poſſible the bad effects of an exceſs of fruit, Mr Marſhal recommends "to graft in the boughs," and when fully grown, to thin the bearing branches; thus endeavouring, like the gardener, to grow fruit every year."

Duration of fruit trees may be lengthened.

8. Though it is impoſſible to prevent the effects of old age, yet by proper management the natural life of fruit trees may be conſiderably protracted. The moſt eligible method is to graft ſtocks of the native crab in the boughs. The decline of the tree is preceded by a gradual decline of fruitfulneſs, which takes place long before the tree manifeſts any ſign of decay. During this decline of fruitfulneſs, there is a certain period when the produce of a tree will no longer pay for the ground it occupies; and beyond this period it ought by no means to be allowed to ſtand. In the Vale of Glouceſter, however, our author ſaw an inſtance of ſome healthy bearing apple trees, which then had the *ſecond* tops to the ſame ſtems. The former tops having been worn out, were cut off, and the ſtumps ſaw-grafted. Our author obſerves, that the pear tree is much longer lived than the apple, and ought never to be planted in the ſame ground. He concludes with the following general obſervation: Thus conſidering fruit trees as a crop in huſbandry, the general management appears to be this: Plant upon a recently broken-up

Mr Marſhal's obſervation on the culture of fruit trees.

ken-up worn-out ſward. Keep the ſoil under a ſtate of arable management, until the trees be well grown; then lay it down to graſs, and let it remain in ſward until the trees be removed, and their roots be decayed; when it will again require a courſe of arable management." Cultivation of Fruit.

In conſequence of an addreſs of the houſe of commons, his majeſty in 1791 granted a pecuniary reward to Mr William Forſyth for diſcloſing the following method of making and uſing a compoſition for curing diſeaſes, defects, and injuries, in all kinds of fruit and foreſt trees. Forſyth's cure for diſeaſes of trees.

"Take one buſhel of freſh cow-dung, half a buſhel of lime rubbiſh of old buildings (that from the ceilings of rooms is preferable) half a buſhel of wood-aſhes, and a ſixteenth part of a buſhel of pit or river ſand. The three laſt articles are to be ſifted fine before they are mixed; then work them well together with a ſpade, and afterwards with a wooder beater, until the ſtuff is very ſmooth, like fine plaiſter uſed for the ceilings of rooms.

"The compoſition being thus made, care muſt be taken to prepare the tree properly for its application, by cutting away all the dead, decayed, and injured part, till you come to the freſh ſound wood; leaving the ſurface of the wood very ſmooth, and rounding off the edges of the bark with a draw-knife or other inſtrument, perfectly ſmooth, which muſt be particularly attended to; then lay on the plaiſter about one-eighth of an inch thick all over the part where the wood or bark has been ſo cut away, finiſhing off the edges as thin as poſſible. Then take a quantity of dry powder of wood-aſhes mixed with a ſixth part of the ſame quantity of the aſhes of burnt bones; put it into a tin-box, with holes

in

Cultivation of Fruit.

in the top, and ſhake the powder on the ſurface of the plaiſter, till the whole is covered over with it, letting it remain for half an hour to abſorb the moiſture; then apply more powder, rubbing it gently, with the hand, and repeating the application of the powder till the whole plaiſter becomes a dry ſmooth ſurface.

"All trees cut down near the ground ſhould have the ſurface made quite ſmooth, rounding it off in a ſmall degree as before mentioned; and the dry powder directed to be uſed afterwards ſhould have an equal quantity of powder of alabaſter mixed with it, in order the better to reſiſt the dripping of trees and heavy rains.

"If any of the compoſition be left for a future occaſion, it ſhould be kept in a tub or other veſſel, and urine of any kind poured on it, ſo as to cover the ſurface, otherwiſe the atmoſphere will greatly hurt the efficacy of the application.

"Where lime rubbiſh of old buildings cannot be eaſily got, take powdered chalk or common lime, after having been ſlaked a month at leaſt.

"As the growth of the tree will gradually affect the plaiſter by raiſing up its edges next the bark, care ſhould be taken, where that happens, to rub it over with the finger, when occaſion may require (which is beſt done when moiſtened by rain), that the plaiſter may be kept whole to prevent the air and wet from penetrating into the wound.

"The following is a more expeditious way of laying on the plaiſter. Take a quantity ready made, and mix up with urine or ſoap-ſuds to the conſiſtency of thick paint, and lay on the wounds of the trees prepared for

its

its reception, with a painter's brush. The diseased part must be gone over a second time, as one coating is scarcely sufficient for large wounds, then proceed as above. Cultivation of Fruit.

The following wash is said have proved very effectual in Nova Scotia in removing insects and moss from fruit trees. The tendency of lime to destroy the moss plants is so great, that we account it worthy of general attention *. "Take a quantity of unslaked lime, mix it with as soft water as your situation will furnish, to the consistency of very thick white-wash; this mixture, with a soft paint-brush, apply to your apple trees as soon as you judge the sap begins to rise, and wash the stem and large boughs well with it, observing to have it done in dry weather, that it may adhere and withstand rain; you will find, that in the course of the ensuing summer, it will remove all moss and insects, and give to the bark a fresh green appearance; and that the tree will shoot much new and strong wood; at least it did so in Nova Scotia. The trial is simple, and can neither be attended with much expence, trouble, or danger." Wash from removing moss.

* *Annals of Agriculture*, vol. xxxii.

Timber Trees.

SECT. IX.

OF TIMBER TREES.

THE importance and value of theſe are ſo well known, that it is ſuperfluous to ſay any thing on that ſubject at preſent: notwithſtanding this acknowledged value, however, the growth of timber is ſo ſlow, and the returns for planting ſo diſtant, that it is generally ſuppoſed for a long time to be a poſitive loſs, or at leaſt to be attended with no profit. This matter, however, when properly conſidered, will appear in another light.

Different kinds of woodlands.

There are four diſtinct ſpecies of woodlands; viz. woods, timber groves, coppices, and woody waſtes. The woods are a collection of timber trees and underwood; the timber groves contain timber trees without any underwood; and the coppices are collections of underwood alone. All theſe turn out to advantage ſooner or later, according to the quick or ſlow growth of the trees, and the ſituation of the place with reſpect to certain local advantages. Thus in ſome places underwood is of great conſequence, as for rails, hoops, ſtakes, fuel, &c. and by reaſon of the quickneſs of its growth it may be accounted the moſt profitable of all plantations.

What plantation will ſooneſt bring in a return of profit.

An oſier-bed will yield a return of profit the ſecond or third year, and a coppice in 15 or 20 years; while a plantation of oaks will not arrive at perfection in leſs than a century. This laſt period is ſo long, that it may not unreaſonably be ſuppoſed likely to deter people from making plantations of this

this kind, as few are willing to take any trouble for what they are never to ſee in perfection. It muſt be remembered, however, that though the trees themſelves do not come to perfection in a ſhorter time, the value of the land will always increaſe in proportion to their age. Thus, ſays one author upon this ſubject, "we have ſome knowledge of a gentleman now living, who, during his lifetime, has made plantations, which, in all probability, will be worth to his ſon as much as his whole eſtate, handſome as it is. Suppoſing that thoſe plantations have been made 50 or 60 years, and that in the courſe of 20 or 30 more they will be worth 50,000l; may we not ſay, that at preſent they are worth ſome 20,000l. or 30,000l.? Mr Pavier, in the 4th volume of Bath Papers, computes the value of 50 acres of oak timber in 100 years to be 12,100l. which is nearly 50s. annually per acre; and if we conſider that this is continually accumulating, without any of that expence or riſk to which annual crops are ſubject, it is probable that timber planting may be accounted one of the moſt profitable articles in huſbandry. Evelyn calculates the profit of 1000 acres of oak-land in 150 years, at no leſs than 670,000l.; but this is moſt probably an exaggeration. At any rate, however, it would be improper to occupy, eſpecially with timber of ſuch ſlow growth, the grounds which either in graſs or corn can repay the trouble of cultivation with a good annual crop.

Timber Trees.

Advantages of planting.

In the fourth volume of the Bath Papers, Mr Wagſtaffe recommends planting as an auxiliary to cultivation. He brings an inſtance of the ſucceſs of Sir William Jerringham, who made trial of "the moſt unpromiſing ground perhaps that any ſucceſsful planter has

Planting meliorates the ſoil.

Timber Trees.

hitherto attempted." His method was to plant beech trees at proper diſtances among Scotch firs, upon otherwiſe barren heaths. "Theſe trees (ſays Mr Wagſtaffe), in a ſoil perhaps without clay or loam, with the heathy ſod trenched into its broken ſtrata of ſand or gravel, under the protection of the firs, have laid hold, though ſlowly, of the ſoil; and, accelerated by the ſuperior growth of the firs, have proportionally riſen, until they wanted an enlargement of ſpace for growth when the firs were cut down." He next proceeds to obſerve, that when the firs are felled, their roots decay in the ground; and thus furniſh by that decay a new ſupport to the ſoil on which the beeches grow: by which means the latter receive an additional vigour, as well as an enlargement of ſpace and freer air; the firs themſelves, though cut down before they arrived at their full growth, being alſo applicable to many valuable purpoſes.

Culture of timber trees recommended by Mr Harries.

In the 6th volume of Annals of Agriculture, we find the culture of trees recommended by Mr Harries: and he informs us, that the larch is the quickeſt grower and the moſt valuable of all the reſinous timber trees; but unleſs there be pretty good room allowed for the branches to ſtretch out on the lower part of the trunk, it will not arrive at any conſiderable ſize; and this obſervation, he ſays, holds good of all pyramidal trees. Scotch firs may be planted between them, and pulled out after they begin to obſtruct the growth of the larch. Some of theſe larches he had ſeen planted about 30 years before, which at 5 feet diſtance from the ground, meaſured from 4 feet to 5 feet 6 inches in circumference. The moſt barren grounds, he ſays, would anſwer for theſe trees, but better ſoil is required for the

oaks.

oaks. In this paper he takes notice of the leaves of one of his plantations of oaks having been almoſt entirely deſtroyed by inſects; in conſequence of which they did not increaſe in bulk as uſual: but another which had nearly eſcaped theſe ravages, increaſed at an average one inch in circumference. "A tree four feet round (ſays he), that has timber twenty feet in length, gains by this growth a ſolid foot of timber annually, worth one ſhilling at leaſt, and pays 5 *per cent.* for ſtanding. It increaſes more as the tree gets from five to ſix feet round. I have a reaſonable hope to infer from my inquiry, that I have in my groves three thouſand oaks that pay me one ſhilling each *per annum*, or 150l. a-year. My poplars have gained in circumference near two inches, and a Worceſter and witch elm as much. I have lately been informed, that the ſmooth cut of a holly tree, that meaſures twenty inches and upwards round, is worth to the cabinet-makers 2s. 6d. per foot.

Timber Trees.

Increaſe of oak trees.

The following table ſhows the increaſe of trees in twenty-one years from their firſt planting. It was taken from the marquis of Lanſdowne's plantation, begun in the year 1765, and the calculation made on the 15th of July 1786. It is about ſix acres in extent; the ſoil, partly a ſwampy meadow upon a gravelly bottom. The meaſures were taken at 5 feet above the ſurface of the ground; the ſmall firs having been occaſionally drawn for poſts and rails, as well as rafters for cottages; and when peeled of the bark, will ſtand well for ſeven years.

Increaſe of trees in the marquis of Lanſdowne's plantation.

Timber Trees.

	Height in Feet.	Circumference in Feet.	Inches.
Lombardy poplar	60 to 80	4	8
Arbeal	50 to 70	4	
Plane	50 to 60	3	6
Acacia	50 to 60	2	4
Elm	40 to 60	3	6
Chefnut	30 to 50	2	9
Weymouth pines	30 to 50	2	5
Cluſter ditto	30 to 50	2	5
Scotch fir	30 to 50	2	10
Spruce ditto	30 to 50	2	2
Larch	50 to 60	3	10

From this table it appears, that planting of timber trees, where the return can be waited for during a period of 20 years, will undoubtedly repay the original profits of planting, as well as the intereſt of the money laid out; which is the better worth the attention of a proprietor of land, as the ground on which they grow may be ſuppoſed good for very little elſe. From a comparative table of the growth of oak, aſh, and elm timber, given in the 11th volume of the Annals of Agriculture, it appears that the oak is by much the ſloweſt grower of the three.

Of underwood, &c.

With reſpect to the growth of underwood, which in ſome caſes is very valuable, it is to be remarked, that in order to have an annual fall of it, the whole quantity of ground, whatever its extent may be, ought to be divided into annual ſowings. The exact number of ſowings muſt be regulated by the uſes to which it is intended to be put. Thus if, as in Surrey, ſtakes, edders, and hoops are ſaleable, there ought to be eight or ten annual ſowings; or, if, as in Kent, hop-

poles

poles are demanded, 14 or 15 will be required; and if, as in Yorkſhire, rails be wanted, or, as in Glouceſterſhire, cordwood be moſt marketable, 18 or 20 ſowings will be neceſſary to produce a ſucceſſion of annual falls. Thus the buſineſs, by being divided, will be rendered leſs burthenſome: a certain proportion being every year to be done, a regular ſet of hands will, in proper ſeaſon, be employed; and by beginning upon a ſmall ſcale, the errors of the firſt year will be corrected in the practice of the ſecond, and thoſe of the ſecond in that of the third. The produce of the intervals will fall into regular courſe; and when the whole is completed, the falls will follow each other in regular ſucceſſion. The greateſt objection to this method of ſowing woodlands is the extraordinary trouble in fencing: but this objection does not hold, if the ſowings lie at a diſtance from one another; on the contrary, if they lie together, or in plots, the entire plot may be encloſed at once; and if it contain a number of ſowings, ſome ſubdiviſions will be neceſſary, and the annual ſowings of theſe ſubdiviſions may be fenced off with hurdles, or ſome other temporary contrivance; but if the adjoining land be kept under the plough, little temporary fencing will be neceſſary. It muſt be obſerved, however, that in raiſing a woodland from ſeeds, it is not only neceſſary to defend the young plants againſt cattle and ſheep, but againſt hares and rabbits alſo; ſo that a cloſe fence of ſome kind is abſolutely neceſſary. Timber Trees.

With regard to the preparation of the ground for raiſing timber, it may be obſerved, that if the ſoil be of a ſtiff clayey nature, it ſhould receive a whole year's fallow, as for wheat; if light, a crop of turnips may

Timber Trees.

be taken; but at all events it muſt be made perfectly clean before the tree ſeeds be ſown, particularly from perennial root weeds; as, after the ſeeds are ſown, the opportunity of performing this neceſſary buſineſs is in a great meaſure loſt. If the ſituation be moiſt, the ſoil ſhould be gathered into wide lands, ſufficiently round to let the water run off from the ſurface, but not high. The time of ſowing is either the month of October or March; and the method as follows: "The land being in fine order, and the ſeaſon favourable, the whole ſhould be ſown with corn or pulſe adapted to the ſeaſon of ſowing; if in autumn, wheat or rye may be the crop; but, if in ſpring, beans or oats. Whichever of theſe three ſpecies be adapted, the quantity of ſeed ought to be leſs than uſual, in order to give a free admiſſion of air, and prevent the crop from lodging. The ſowing of the grain being completed, that of the tree-ſeeds muſt be immediately ſet about. Theſe are to be put in drills acroſs the land: acorns and nuts ſhould be dibbled in, but keys and berries ſcattered in trenches or drills drawn with the corner of a hoe, in the manner that gardeners ſow their peaſe. The diſtance might be a quarter of a ſtatute rod, or four feet and one inch and a half. A land-chain ſhould be uſed in ſetting out the drills, as not being liable to be lengthened or ſhortened by the weather. It is readily divided into rods; and the quarters may be eaſily marked.

Method of ſowing.

The ſpecies of underwood to be ſown muſt be determined by the conſumpt of it in the neighbourhood of the plantation. Thus if ſtakes, hoops, &c. be in requeſt, the oak, hazel, and aſh, are eſteemed as underwood. When charcoal is wanted for iron forges,

forges, beech is the prevailing underwood. The oak, box, birch, &c. are all in requeſt in different countries; and the choice muſt be determined by the prevailing demand. As the keys of the aſh ſometimes lie two or even three years in the ground, it will be proper to have the places where they are ſown diſtinguiſhed by ſome particular marks, to prevent them from being diſturbed by the plough after harveſt; as a few beans ſcattered along with them, if the crop be oats; or oats, if the crop be beans. The crop ſhould be *reaped*, not *mown*, at harveſt time, and be carried off as faſt as poſſible. Between harveſt and winter, a pair of furrows ſhould be laid back to back in the middle of each interval, for meliorating the next year's crop, and laying the ſeedling plants dry; while the ſtubble of the unploughed ground on each ſide of the drills will keep them warm during winter. The next year's crop may be potatoes, cabbages, turnips: or if the firſt was corn, this may be beans; if the firſt was beans, this may be wheat drilled. In the ſpring of the third year the drills which roſe the firſt year muſt be looked over, and the vacancies filled up from thoſe parts which are thickeſt; but the drills of the aſh ſhould be let alone till the fourth year. The whole ſhould afterwards be looked over from time to time; and this, with cultivating the intervals, and keeping the drills free from weeds, will be all that is neceſſary until the tops of the plants begin to interfere. Timber Trees.

The crops may be continued for ſeveral years; and if they only pay for the expences, they will ſtill be of conſiderable advantage by keeping the ground ſtirred, and preſerving the plants from hares and rabbits. Even after the crops are diſcontinued, the ground Annual crops uſeful in plantations.

Timber Trees.

ought ſtill to be ſtirred, alternately throwing the mould to the roots of the plants, and gathering it into a ridge in the middle of the interval. The beſt method of doing this is to ſplit the ground at the approach of winter in order to throw it up to the trees on both ſides; this will preſerve the roots from froſt: gather it again in the ſpring, which will check the weeds, and give a freſh ſupply of air: ſplit again at midſummer, to preſerve the plants from drought: gather, if neceſſary, in autumn, and ſplit as before at the approach of winter. The ſpring and midſummer ploughings ſhould be continued as long as a plough can paſs between the plants.

Whenever the oaks intended for timber are in danger of being drawn up too ſlender for their height, it will be neceſſary to cut off all the reſt at the height of about an handbreadth above the ground; and thoſe deſigned to ſtand muſt now be planted at about two rods diſtant from each other, and as nearly a quincunx as poſſible. The ſecond cutting muſt be determined by the demand there is for the underwood; with only this proviſo, that the timber ſtands be not too much crowded by it; for rather than this ſhould be the caſe, the coppice ſhould be cut, though the wood may not have reached its moſt profitable ſtate. What is here ſaid of the method of rearing oak trees in woods, is in a great meaſure applicable to that of raiſing other trees in timber groves. The ſpecies moſt uſually raiſed in theſe are the aſh, elm, beech, larch, ſpruce fir, Weymouth pine, poplar, willow, alder, cheſnet, walnut, and cherry. The three laſt are uſed as ſubſtitutes for the oak and beech, and theſe two for the mahogany.

The

The following account of the mode of planting that was adopted by the earl of Fife, for no leſs than 550 acres of mooriſh lands, is worthy of attention. It is contained in a letter from his lordſhip to the publiſher of the Annals of Agriculture, vol ix. "Where there are ſtones in the moor, I incloſe with a ſtone wall five feet high, coped with two turfs, which coſt about 15s. every Scots chain of 24 ells; and where there are no ſtones, which is moſtly the caſe in the moors in the county of Murray, I incloſe with a fence of turf, five feet high, four feet wide at the foundation, and 22 inches at top, at 4s. the Scots chain. I find theſe fences anſwer as well as the ſtone; for there are many of them, now above 20 years old, as good as at firſt. I plant in every acre about 1200 trees. I uſed to plant above 3000, but by experience I find it better not to plant them ſo thick, but make them up, if neceſſary, the third year (eſpecially in my plantations in the county of Murray), where ſcarcely a tree planted ever fails. The greateſt number of the trees are Scots firs raiſed by myſelf, or purchaſed at 10d. the thouſand, planted from the ſeed-bed at three years old. I only conſidered them as nurſes to my other trees, for they are regularly cut out when they have done their duty as nurſes, and are profitable for fire, and uſeful in agriculture. I plant every other ſpecies of foreſt trees intermixed with the firs. I order different pieces of the moor to be trenched where the ſoil is beſt, and moſt ſheltered, and lay a little lime and dung on it, and in theſe places I ſow ſeeds of trees for nurſery. I alſo plant in beds, year-old trees of different kinds, taken from my other nurſeries. I nurſe them for three years, and then plant them all over the plantation: this I find very beneficial,

Timber Trees.

Earl of Fife's plantations.

Timber Trees.

cial, as they are raiſed in the ſame ſoil. When I am filling up the plantations, the firs are, for the firſt time, cut down; or they are tranſplanted, being raiſed with balls of earth when the moor is wet with rain, which is very eaſily done, and they are carried to incloſures of ten or twelve acres, where, from a deſire of forward woods, I am planting trees more advanced. They are planted it pits about 40 feet diſtance, and ſeldom or never fail, and anſwer a ſecond time as nurſes.

"My firſt care after the incloſure is properly filled up, is to guard againſt injury from cattle: a ſmall allowance given to a few labourers anſwers that purpoſe, and if the fences are properly executed they require very little repair. After the plantation is filled up, the moſt regular attention muſt be had to the weeding of it, and this is carried on over my plantations of all ages in the moſt exact manner; I make roads through all the plantations which are carried forward according to the ſituation, never in a ſtraight line ſo as to draw violent winds, and thoſe roads go to all parts of the plantation; they make agreeable rides through fine woods, formerly a bleak moor, and anſwer not only for filling up, but alſo for carrying away the neceſſary weedings. As I obſerved before, the value and proſperity of the wood depends upon the unremitted attention in weeding it.

"I begin to plant in October, and continue till April. If the weather is froſty and not fit for planting, all the people are employed in weeding the woods."

The total want of growing timber upon a farm is frequently attended with much expence and inconvenience. It often deters an enterpriſing man from erecting

ing ſheds, hogs-ſties, cow-houſes, &c. by which the live ſtock upon the farm might be increaſed, or the quantity of manure made upon it might be augmented. Hence we are induced to call the attention of the reader to an experiment made by Mr Young in 1777 and the following years: At different times, during nine years, from that period, he planted about ſeven acres and a half, chiefly of very poor land; the principal trees were larches, Scotch and ſpruce firs, and Lombardy poplars, intermixed with ſome oaks, aſhes, and elms. In 1799, that is to ſay, 22 years from the commencement of the experiment, the particulars of which we ſhall not detail; he ſpeaks thus upon the ſubject *: "In the acre of 1777 the beſt larch are from two feet to two feet ſix inches in circumference, at five feet from the ground, and about 36 feet high; and in general varying from one foot to two. The beſt ſpruce are about two feet, and 32 high. The Scotch at five feet from the ground, not leſs in ſize, but not near ſo ſtraight, taperng, or high. The beſt oaks from one foot five to one foot nine, and 20 high. The two acres of 1778, the beſt larch about two feet, and 30 high; in general from one to two feet. The ſpruce inferior; the Scotch ſtill more ſo, and of a much leſs value. The oaks thriving and and very fair.

Timber Trees.

Plantation on a farm by Mr Young.

"The four acres, the beſt larch from one foot ſeven to two feet two. The Scotch, on an average, one foot ſeven, and 20 high: not equal to the ſpruce, and more inferior to the larch: the elms nothing.

"The Lombardy poplars in all the plantations. Very

* *Annals of Agriculture*, vol. xxxiv.

Timber Trees. Very few of the black poplars are alive, and of no growth.

"The half acre of 1787 are thriven greatly: in 12 years they form uſeful rails.

"In regard to the return which theſe plantations have made me, when I began thinning long ago, I kept an account, but found the attention too much to do it accurately. I can, therefore, only ſpeak in general, that, for theſe laſt ſeven or eight years, I have found the uſe of them incredibly great, even on this (for its ſize) very well timbered eſtate. They have furniſhed an immenſe quantity of poſts, rails, ſpars, narrow ſlabs, boards, rafters; and, in a word, every ſort of conſumption, by repairs and new buildings, ſheds, ſties, barns, ſtables, &c. and, as I have ſold none, I have not yet got through the the firſt thinning of all, except where thriving oaks have demanded to be freed from their too near neighbours. The trees have ſuffered in ſize and value for want of earlier thinning; but their thickneſs, in parts, has its convenience in furniſhing rails, a moderate ſcantling, and good length. Whether the produce has equalled the annual expence of rent, &c. I am unable to aſcertain; but the convenience and agreeableneſs of this plenty of ſuch articles make me well ſatisfied: and for the future I have no doubt of an immenſe value in the larger trees, when they come to be ſet out at proper diſtances, not to ſpeak of oak, for future generations.

Advantage of a ſmall plantation.

"Had all been larch, inſtead of having planted any Scotch fir, the difference in the profit would have been immenſe. The chief uſe of the Scotch fir is for poſts, as they thicken too much, and are too ſhort for rails, in compariſon with the other ſorts.

"Upon the whole, I am inclined to believe, that there

there is no land on the eſtate of double the fertility that will pay equally with theſe ſeven and a half acres. Timber Trees.

"The concluſion, however, is not to be extended at this profit to planting on a very large ſcale; the great value reſults from having only this ſmall quantity. If I had ten times as much land thus occupied, I muſt depend on felling; and then the market might be overſtocked, and prices ſunk greatly, with a difficulty, in ſome years of getting rid of them at all, whatever the profit might be in the end, by large ſcantlings always ſaleable; but for a few acres the benefit is ſo great, that no eſtate ought to be without ſuch a reſource."

It is proper upon this ſubject to remark, that the value of large plantations of timber trees, as connected with other branches of agriculture, is not a little limited. In a mountainous country, and in bleak moorish ſituations, nothing tends more to increaſe the value of the ſoil, than plantations properly diſtributed. They give ſhelter both to the cattle and to the corn crops; and by preventing the warmth which is produced by proper manures, and by the germination of vegetables, from being diſſipated, they give effect to all the efforts of induſtry. Accordingly, in ſuch ſituations, plantations are no ſooner reared, than the whole face of the country round them aſſumes an improving aſpect, and diſplays a richer verdure. When ſuddenly cut down, in conſequence of the neceſſities of an improvident proprietor, the reverſe of all this occurs. Vegetation is chilled by the piercing blaſts which now meet with no reſiſtance, and the cattle droop from want of ſhelter; ſo that in a few years the place can ſcarcely be known. But the caſe is very different with regard to a rich and level country that is meant to be cultivated Where plantations are eligible or otherwiſe.

Timber Trees.

vated for corn. There the effect of numerous plantations, of high trees and lofty hedge rows, is altogether diſtreſſing to the huſbandman. It is only in open fields that grain appears well ripened and completely filled. When ſurrounded with timber trees, on the contrary, it ripens ill, and is ill coloured and unequal. In ſpring the high ſhelter prevents the grounds from drying, and keeps back the labour. In ſummer the crop is liable to diſeaſes from want of air, and is devoured by large flocks of ſmall birds. In autumn, from want of a free circulation of air the corn ripens late, and in a weeping climate it can never be gathered in good condition. In wet ſeaſons it is utterly ruined. In winter, when the ſnow is drifting about, the trees prepare a reſting place for large quantities of it; theſe frequently remain and ſtop the ſpring work. Add to this, that in a low country even the cattle are hurt by the ſwarms of vermine that are bred, and come forth under the ſhelter of lofty trees and high fences.

PART

Cattle proper to be employed.

PART III.

OF THE CATTLE PROPER TO BE EMPLOYED IN FARM WORK; REARING AND MANAGEMENT OF THEM, OF HOGS, POULTRY, &c. OF THE DAIRY. MAKING OF FRUIT LIQUORS. OF FENCES.

SECT. I.

OF THE CATTLE PROPER TO BE EMPLOYED.

AS great part of the ſtock of a huſbandman muſt always conſiſt of cattle, and as one of his principal expences muſt conſiſt of the maintenance of them, this part of his buſineſs is certainly to be looked upon as extremely important. The cattle belonging to a farm may be divided into two claſſes, viz. ſuch as are intended for work, and ſuch as are deſigned for ſale. The former are now principally horſes; the oxen formerly employed being fallen into diſuſe, though it does not yet certainly appear that the reaſons for the exchange are ſatisfactory. In the ſecond volume of Bath Papers, we have an account of a comparative experiment of the utility of horſes and oxen in huſbandry by Mr Keddington near Bury in Suffolk, in which the preference is deciſively given to oxen. He informs us, that at the time he began the experiment (in 1779), he was almoſt certain that there was not an ox worked

Mr Keddington's experiment on the comparative utility of horſes and oxen.

in

Cattle proper to be employed.

in the whole county; finding, however, the expence of horſes very great, he purchaſed a ſingle pair of oxen, but found much difficulty in breaking them, as the workmen were ſo much prejudiced againſt them, that they would not take the proper pains. At laſt he met with a labourer who undertook the taſk; and the oxen "ſoon became as tractable and as handy, both at ploughing and carting, as any horſes." On this he determined to part with all his cart-horſes; and by the time he wrote his letter, which was in 1781, he had not a ſingle horſe, nor any more than ſix oxen: which inconſiderable number performed with eaſe all the work of his farm (conſiſting of upwards of 100 acres of arable land and 60 of paſture and wood), beſides the ſtatute duty on the highways, timber and corn carting, harrowing, rolling, and every part of rural buſineſs. They are conſtantly ſhoed; their harneſs is the ſame as that of horſes (excepting the neceſſary alterations for difference of ſize and ſhape); they are driven with bridles and bits in their mouths, anſwering to the ſame words of the ploughman and carter as horſes will do. A ſingle man holds the plough and drives a pair of oxen with reins: and our author informs us, that they will plough an acre of ground in leſs than eight hours time; he is of opinion that they could do it in ſeven. The intervals of a ſmall plantation, in which the trees are ſet in rows ten feet aſunder, are ploughed by a ſingle ox with a light plough, and he is driven by the man that holds it. The oxen go in a cart either ſingle, or one, two, or three, according to the load. Four oxen will draw 80 buſhels of barley or oats in a waggon with eaſe; and if good of their kind, will travel as faſt as horſes with the ſame load.

load. One ox will draw 40 bushels in a light cart, which our author thinks is the best carriage of any. On the whole, he prefers oxen to horses for the following reasons. Cattle proper to be employed.

1. They are kept at much less expence, never eating meal or corn of any kind. In winter they are fed with straw, turnips, carrots, or cabbages; or, instead of the three last, they have each a peck of bran per day while kept constantly at work. In the spring they eat hay; and if working harder than usual in seed-time, they have bran besides. When the vetches are fit for mowing, they get them only in the stable. After the day's work in summer they have a small bundle of hay, and stand in the stable till they cool; after which they are turned into the pasture. Our author is of opinion, than an ox may be maintained in condition for the same constant work as a horse, for at least 4l. less annually. Reasons for preferring oxen to horses.

2. After a horse is seven years old, his value declines every year; and when lame, blind, or very old, he is scarce worth any thing; but an ox, in any of these situations, may be fatted, and sold for even more than the first purchase; and will always be fat sooner after work than before.

3. Oxen are less liable to diseases than horses.

4. Horses are frequently liable to be spoiled by servants riding them without their master's knowledge, which is not the case with oxen.

5. A general use of oxen would make beef plentiful, and consequently all other meat; which would be a national benefit.

Mr Kedington concludes his paper with acknowledging, that there is one inconvenience attending the Difficulty in shoeing oxen.

Cattle proper to be employed.

uſe of oxen, viz. that it is difficult to ſhoe them; though even this, he thinks, is owing rather to the unſkilfulneſs of the ſmiths who have not been accuſtomed to ſhoe theſe animals, than to any real difficulty. He confines them in a pound while the operation is performing.

Mr Marſhal's calculations.

Mr Marſhal, in his Rural Economy of the Midland Counties, ſhows the advantage of employing oxen in preference to horſes, from the mere article of expence, which, according to his calculation, is enormous on the part of the horſes. He begins with eſtimating the number of ſquare miles contained in the kingdom of England; and this he ſuppoſes to be 30,000 of cultivated ground. Suppoſing the work of huſbandry to be done by horſes only, and each ſquare mile to employ 20 horſes, which is about three to 100 acres, the whole number uſed throughout Britain would be 600,000; from which deducting one-ſixth for the number of oxen employed at preſent, the number of horſes juſt now employed will be 500,000. Admitting that each horſe works ten years, the number of farm-horſes which die annually are no fewer than 50,000; each of which requires full four years keep before he is fit for work. Horſes indeed are broke in at three, ſome at two years old, but they are, or ought to be, indulged in keep and work till they are ſix; ſo that the coſt of rearing and keeping may be laid at full four ordinary years. For all this conſumption of vegetable produce he returns not the community a ſingle article of food, clothing, or commerce; even his ſkin for economical purpoſes being barely worth the taking off. By working horſes in the affairs of huſbandry, therefore, "the community is loſing annually the amount

of

of 100,000 years keep of a growing horſe;" which at the low eſtimate of five pounds a-year, amounts to a million annually. On the contrary, ſuppoſing the buſineſs of huſbandry to be done ſolely by cattle, and admitting that oxen may be fattened with the ſame expenditure of vegetable produce as that which old horſes require to fit them for full work, and that inſtead of 50,000 horſes dying, 50,000 oxen, of no more than 52 ſtone each, are annually ſlaughtered; it is evident, that a quantity of beef nearly equal to what the city of London conſumes would be annually brought into the market; or, in other words, 100,000 additional inhabitants might be ſupplied with one pound of animal food a-day each; and this without conſuming one additional blade of graſs. "I am far from expecting (ſays Mr Marſhal), that cattle will, in a ſhort ſpace of time, become the univerſal beaſts of draught in huſbandry; nor will I contend, that under the preſent circumſtances of the iſland they ought in ſtrict propriety to be uſed. But I know that cattle, under proper management, and kept to a proper age, are equal to every work of huſbandry, in moſt, if not all ſituations: And I am certain, that a much greater proportion than there is at preſent might be worked with conſiderable advantage, not to the community only, but to the owners and occupiers of lands. If only one of the 50,000 carcaſes now loſt annually to the community could be reclaimed, the ſaving would be an object."

Cattle proper to be employed.

A million annually loſt by keeping horſes.

In Norfolk, our author informs us, that horſes are the only beaſts of labour; and that there is not perhaps one ox worked throughout the whole county. It is the ſame in the Vale of Glouceſter, though oxen

No oxen uſed in Norfolk.

Cattle proper to be employed.

are uſed in the adjoining counties. Formerly ſome oxen were worked in it double; but they were found to poach the land too much, and were therefore given up. Even when worked ſingle, the ſame objection is made: but, ſays Mr Marſhal, "in this I ſuſpect there is a ſpice of obſtinacy in the old way, a want of a due portion of the ſpirit of improvement; a kind of indolence. It might not perhaps be too ſevere to ſay of the Vale farmers, that they would rather be eaten up by their horſes than ſtep out of the beaten track to avoid them." Shoeing oxen with whole ſhoes, in our author's opinion, might remedy the evil complained of; "but if not, let thoſe (ſays he) who are advocates for oxen, calculate the comparative difference in *wear* and keep, and thoſe who are their enemies eſtimate the comparative miſchiefs of treading; and thus decide upon their value as beaſts of labour in the Vale." In the Cotſwold oxen are worked as well as horſes; but the latter, our author fears, are ſtill in the proportion of two to one: he has the ſatisfaction to find, however, that the former are coming into more general uſe. They are worked in harneſs; the collar and harneſs being uſed as for horſes, not reverſed, as in moſt caſes they are for oxen. "They appear (ſays our author) to be perfectly handy; and work, either at plough or cart, in a manner which ſhows, that although horſes may be in ſome caſes *convenient*, and in moſt caſes *pleaſurable to the driver*, they are by no means *neceſſary* to huſbandry. A convenience uſed in this country is a moveable *harneſs-houſe* with a ſledge bottom, which is drawn from place to place as occaſion may require. Thus no labour is loſt either by the oxen or their drivers.

Objection to them in the Vale of Glouceſter.

Uſed in the Cotſwold.

Moveable harneſs-houſes.

In

In Yorkſhire oxen are ſtill uſed, though in much fewer numbers than formerly; but our author does not imagine this to be any deciſive argument againſt their utility. The Yorkſhire plough was formerly of ſuch an unwieldy conſtruction, that four or ſix oxen, in yokes, led by two horſes, were abſolutely requiſite to draw it; but the improvements in the conſtruction of the plough have of late been ſo great, that two horſes are found to be ſufficient for the purpoſe; ſo that as Yorkſhire has all along been famous for its breed of horſes, we are not to wonder at the preſent diſuſe of oxen. Even in carriages they are now much diſuſed; but Mr Marſhall aſſigns as a reaſon for this, that the roads were formerly deep in winter, and ſoft to the hoof in ſummer; but now they are univerſally a cauſeway of hard limeſtones, which hurt the feet of oxen even when ſhod. Thus it even appears matter of ſurpriſe to our author that ſo many oxen are employed in this county; and the employment of them at all is to him a convincing argument of their utility as beaſts of draught. The timber carriers ſtill continue to uſe them, even though their employment be ſolely upon the road. They find them not only able to ſtand working every day, provided their feet do not fail them, but to bear long hours better than horſes going in the ſame paſture. An ox in a good paſture ſoon fills his belly, and lies down to reſt; but a horſe can ſcarce ſatisfy his hunger in a ſhort ſummer's night. Oxen are alſo conſidered as much ſuperior at a difficult pull to horſes; but this he is willing to ſuppoſe ariſes from their uſing half-bred hunters in Yorkſhire, and not the true breed of cart horſes. "But what (ſays he) are thorough-bred cart horſes? Why, a ſpecies of ſtrong,

Cattle proper to be employed.

Why the uſe of oxen is declining in Yorkſhire.

Superiority of oxen to horſes.

Cattle proper to be employed.

heavy, ſluggiſh animals, adapted ſolely to the purpoſe of draught; and according to the preſent law of the country, cannot, without an annual expence, which nobody beſtows upon them, be uſed for any other purpoſe. This ſpecies of beaſts of draught coſt at four years old from 20l. to 30l. They will, with extravagant keep, extraordinary care and attendance, and much good luck, continue to labour eight or ten years; and may then generally be ſold for five ſhillings a-head. If we had no other ſpecies of animals adapted to the purpoſes of draught in the iſland, cart horſes would be very valuable, they being much ſuperior to the breed of ſaddle horſes for the purpoſe of draught. But it appears evident, that were only a ſmall ſhare of the attention paid to the breeding of draught oxen which is now beſtowed on the breeding of cart horſes, animals equally powerful, more active, leſs coſtly, equally adapted to the purpoſes of huſbandry if harneſſed with equal judgment, leſs expenſive in keep and attendance, much more durable, and infinitely more valuable after they have finiſhed their labours, might be produced. A ſteer, like a colt, ought to be familiarized to harneſs at two or three years old, but ſhould never be ſubjected to hard labour until he be five years old; from which age until he 15 or perhaps 20, he may be conſidered as in his prime, as a beaſt of draught. An ox which I worked ſeveral years in Surrey might at 17 or 18 years of age have challenged for ſtrength, agility, and ſagacity, the beſt bred cart horſe in the kingdom.

Horſes are everywhere prevailing over oxen.

Notwithſtanding all that has been ſaid, however, and written, about the ſuperiority of oxen to horſes, the latter are ſtill coming into more general uſe, eſpecially

cially in proportion as the breed of horſes improves; and we may add, in proportion as the ſtate of cultivation in any part of the country improves. The reaſon is obvious. The horſe is a more active animal than the ox, and can be turned with greater readineſs from one kind of work to another. His hoof is leſs readily injured by the hardneſs of good roads; and for the uſe of the plough upon a well ordered farm, there is no compariſon between the two kinds of animals. Where land is once brought into a proper ſtate of tillage, it is eaſily turned over; and the value of the animal employed in doing ſo conſiſts not ſo much in the poſſeſſion of great ſtrength as in the activity which he exerts in going over a great extent of ground in a ſhort time. In this laſt reſpect, a good breed of horſes ſo far ſurpaſſes every kind of oxen yet known in this country, that we ſuſpect much the horſe will ſtill continue to be preferred by enterpriſing huſbandmen. Cattle proper to be employed.

With regard to the loſs which the public is ſuppoſed to ſuſtain by preferring horſes to oxen, that point has of late been rendered, to ſay no more, extremely doubtful. In the Agricultural Survey of the county of Northumberland, we have the following comparative ſtatement between horſes and oxen, for the purpoſe of the draught:—"By way of preliminary, it will be neceſſary to admit as data, that a horſe which eats 70 buſhels of oats per year, will not conſume of other food ſo much as an ox that gets no corn; but in the following eſtimate we ſhall allow horſes to eat as much as oxen, as the difference is not yet ſufficiently aſcertained. Calculations in favour of the uſe of horſes.

"That the oxen are yoked at three years old, and are worked till ſix, and for the firſt year require eight

Cattle proper to be employed.

to do the work of two horſes; but after having been worked a year, and become tractable and ſtronger, ſix are equal to two horſes, either by being yoked three at a time, or two, and driven by the holder with cords; of courſe, the expences of a driver may be eſtimated to be ſaved for one half the year.

"That the expences of a ploughman, the plough, and other articles that are the ſame in both teams, need not be taken into the account.

"And that oxen, to work regularly through the year, cannot work more than half a day at a time."

Expence of an Ox per annum.

Summering.—Graſs 2 acres at 20s. per acre - -				L.	2	0 0
Wintering.—On ſtraw and turnips	L.	2	0 0			
But if on hay		4	0 0			
The average is - - -					3	0 0
				L.	5	0 0
Intereſt at 5 *per cent.* for price of the ox					0	10 0
Harneſs, ſhoeing, &c. - -					0	15 0
					6	5 0
Deduct for the increaſed value of an ox for 1 year - - -					1	0 0
Gives the expence *per annum* of an ox for the team - - -					5	5 0
And the expence of 6 oxen -					31	10 0
To which muſt be added the expence of a driver for half a year - -					3	10 0
Total expence of a team of 6 oxen				L.	35	0 0

An

An Eight-Ox Team.

Cattle proper to be employed.

The expence of an ox *per annum* being	L. 5	5	0
			8
That of eight will be - -	42	0	0
To which add the expence of a driver	8	0	0
Gives the expence *per annum* of an eight-ox team - -	L. 50	0	0
Therefore the expence of a team of oxen for the first year will be -	L. 50	0	0
Ditto the second year - -	35	0	0
Ditto the third year - -	35	0	0
Divided by - - -	3)120	0	0
Gives the average expence *per annum* of an ox team from 3 to 6 years old	L. 40	0	0

Expence of a Horse per annum.

Summering.—Grass 2 acres at 20s. per acre - -	L. 2	0	0
Wintering.—Straw 13 weeks at 9d. per week - -	0	10	0
Hay 16 ditto 1½ tons at 2l.	3	0	0
Corn (for a year) 70 bushels of oats at 2l.	7	0	0
Shoeing and harness - -	1	0	0
Annuity to pay off 25l. in 16 years the purchase value of the horse at four years old - - -	2	5	0
Expence of a horse *per annum* -	L. 15	15	0
Expence of a two-horse team	L. 31	10	0

"If

Cattle proper to be employed.

"If a three horſe-team be uſed, the account will ſtand thus:

The expence of a horſe *per annum* being	L.	5 15	0
			3
That of three will be - -		47 5	0
To which add the expence of a driver		8 0	0
Gives the expence of a three-horſe team	L.	55 5	0

"If the compariſon be made with the horſe team of many of the midland counties, where they uſe *five horſes yoked one before another in one plough*, the account will ſtand thus:

The expence of one horſe *per annum* being - - -	L.	15 15	0
			5
That of five will be - -		78 15	0
To which add the expence of a man to drive		18 0	0
The expence of a team of five horſes will be - -	L.	96 15	0
Ditto - of 3 ditto		55 5	6
Ditto - of 2 ditto		31 10	0
Ditto - of 8 oxen		50 0	0
The average expence of an ox-team from three to ſix years old, that will do the ſame quantity of work as two horſes		40 0	0

"The concluſions to be drawn from the above ſtatement, are ſo obvious as to need little elucidation. But we cannot help remarking, how ſtrong the force of prejudice

judice muſt be, to continue the uſe of five horſes, and heavy, clumſy, unwieldy *wheel-ploughs*, where a ſingle *ſwing-plough* and two horſes yoked double, and driven by the holder, would do the ſame quantity of work equally well, and at one half of the expence." Cattle proper to be employed.

"But before any proper concluſion can be drawn, whether *oxen teams* or *horſe* are the moſt eligible, it will be neceſſary to conſider, whether the quantity of land employed in ſupporting thoſe animals, be uſed in the moſt profitable mode to the community, as well as to the occupier.

"With the latter, the firſt queſtion for conſideration is, whether eight oxen uſed in the team or in grazing will pay him the moſt money?

"Suppoſe eight oxen, at *three years old*, were put to the plough, and plough ſix acres per week, which, at 3s. 4d. per acre, is 20s.; and if they work forty-eight weeks in a year, their whole earnings (after deducting 6l. for expences of harneſs, ſhoeing, &c.) will be 42l.; but if they plough only *five acres per week*, (which is probably nearer the truth), then their whole earnings will be only 34l.

"The ſame oxen put to graze at the ſame money ſhould improve in value 5l. 5s. each in the firſt caſe, and 4l. 5s. in the latter; but we are inclined to believe there are few ſituations, if the cattle are of a good quick-feeding kind, where they would not pay conſiderably more.

"In reſpect to the community, the account will be nearly as follows:

"From the above ſtatements, we find that an ox for ſummering and wintering requires - $3\frac{1}{2}$ acres

Therefore

Cattle proper to be employed.

Therefore a ſix-ox team will require -	21	acres
And two horſes for graſs and hay *per annum* require - - - - -	7	ditto.
For corn and ſtraw - - -	4	ditto
Land neceſſary for keeping two horſes *per annum* - - - -	11	ditto
The difference in the quantity of land required for a team of oxen more than horſes	10	ditto

" Hence it appears, that a team of ſix oxen requires ten acres more land to maintain them, than a team of two horſes, which will do the ſame work; and of courſe the produce which might be derived from theſe ten acres is loſt to the community. Suppoſe it be one half in graſs, the other half in tillage, then we ſhall have

" 5 Acres of clover or graſs,
1½ Ditto of oats,
1½ Ditto of turnips or fallow,
1½ Ditto of wheat.

" It would then ſend to market yearly, at the loweſt computation,

7½ cwt. of beef,
8 quarters of oats,
And 5 ditto of wheat.

" From this view of the ſubject, it appears that if oxen were univerſally uſed for the draught, in the room of horſes, there would be a conſiderable defalcation, in the ſupply of the markets, both in corn and animal food. And the loſs to the farmer would be the profit derived from the produce; which, by the uſual mode of allowing one third for the farmer's profit, would in this caſe be about 10l."

SECT.

Different Kinds of Horſes.

SECT. II.

OF THE DIFFERENT KINDS OF HORSES, AND THE METHOD OF BREEDING, REARING, AND FEEDING THEM.

Account of the black cart-horſes.

THE midland counties of England have for ſome time been celebrated on account of their breed of the *black cart-horſe*; though Mr Marſhal is of opinion that this kind are unprofitable as beaſts of draught in huſbandry. The preſent improvement in the breed took its riſe from ſix Zealand mares ſent over by the late Lord Cheſterfield during his embaſſy at the Hague. Theſe mares being lodged at his lordſhip's ſeat at Bretby in Derbyſhire, the breed of horſes thus became improved in that county, and for ſome time it took the lead for the ſpecies of theſe animals. As the improved breed paſſed into Leiceſterſhire, however, through ſome unknown circumſtances, it became ſtill more improved, and Leiceſter has for ſome time taken the lead. It has now been found, however, that the very large horſes formerly bred in this diſtrict are much leſs uſeful than ſuch as are of a ſmaller ſize. Mr Marſhal deſcribes, in magnificent terms, one of theſe large horſes; a ſtallion belonging to Mr Bakewell, named K *, which, he ſays, was the handſomeſt horſe he ever ſaw. "He was (ſays he) the fancied *war horſe* of the German

Horſes belonging to Mr Bakewell deſcribed.

* Mr Bakewell diſtinguiſhes all his horſes, bulls, and rams, by the letters of the alphabet.

Different Kinds of Horſes.

German painters; who, in the luxuriance of imagination, never perhaps excelled the natural grandeur of this horſe. A man of moderate ſize ſeemed to ſhrink behind his fore end, which roſe ſo perfectly upright, his ears ſtood (as Mr Bakewell ſays, every horſe's ears ought to ſtand) perpendicularly over his fore feet. It may be ſaid, with little latitude, that in grandeur and ſymmetry of form, viewed as a pictureable object, be exceeded as far the horſe which this ſuperior breeder had the honour of ſhowing to his majeſty, and which was afterwards ſhown publicly at London, as that horſe does the meaneſt of the breed." A more *uſeful* horſe, bred alſo by Mr Bakewell, however, is deſcribed as having "a thick carcaſe, his back ſhort and ſtraight, and his legs ſhort and clean; as ſtrong as an ox, yet active as a poney; equally ſuitable for a cart or a lighter carriage."

The ſtallions in this county are bred either by farmers or by perſons whoſe buſineſs it is to *breed* them, and who therefore have the name of *breeders*. Theſe laſt either cover with themſelves, or let them out to others for the ſeaſon, or ſell them altogether to ſtallion-men who travel about with them to different places.—The prices given for them are from 50 to 200 guineas by purchaſe; from 40 to 80 or a hundred by the ſeaſon; or from half a guinea to two guineas by the mare. The mares are moſtly kept by the farmers, and are worked until near the times of foaling, and moderately afterwards while they ſuckle: the beſt time for foaling is ſuppoſed to be the month of March or April; and the time of weaning that of November.—"The price of foals (ſays Mr Marſhal), for the laſt ten years, has been from five to ten pounds

Prices of ſtallions.

or

or guineas; for yearlings, 10 to 15 or 20; for two year-olds, 15 to 25 or 30; for ſix-year-olds, from 25 to 40 guineas."—Our author acknowledges that this breed of horſes, conſidered abſtractedly in the light in which they appear here, are evidently a profitable ſpecies of live ſtock, and as far as there is a market for ſix-years-old horſes of this breed, it is profitable to agriculture. "But (ſays he) viewing the buſineſs of agriculture in general, not one occupier in ten can partake of the profit; and being kept in agriculture after they have reached that profitable age, they become indiſputably one of its heavieſt burdens. For beſides a ceſſation of improvement of four or five guineas a-year, a decline in value of as much yearly takes place. Even the brood-mares, after they have paſſed that age, may, unleſs they be of a very ſuperior quality, be deemed unprofitable to the farmer."

Different Kinds of Horſes.

Mr Marſhal's obſervations on breeding horſes.

Our author complains that the ancient breed of Norfolk horſes is almoſt entirely worn out. They were ſmall, brown-muzzled, and light boned; but they could endure very heavy work with little food; two of them were found quite equal to the plough in the ſoil of that county, which is not deep. The preſent breed is produced by a croſs with the large one of Lincolnſhire and Leiceſterſhire already mentioned. He approves of the Suffolk breed, which (he ſays) are a "half-horſe half-hog race of animals, but better adapted to the Norfolk huſbandry than the Leiceſterſhire breed: their principal fault, in his opinion, is a flatneſs of the rib.—In the Vale of Glouceſter moſt farmers rear their own plough-horſes, breeding of horſes not being practiſed. They are of a very uſeful kind, the colour moſtly black, inclinable to tan-colour, ſhort and thick in the

Norfolk breed deſcribed.

Suffolk and Glouceſter breeds.

Different Kinds of Horſes.

the barrel, and low on their legs. The price of a ſix-year-old horſe from 25l. to 35l. Some cart-horſes are bred in Cotſwold hills; the mares are worked till the time of foaling, but not while they ſuckle; and the foals are weaned early, while there is plenty of grain upon the ground.

Yorkſhire horſes.

Yorkſhire, which has been long celebrated for its breed of horſes, ſtill ſtands foremoſt in that reſpect among the Engliſh counties. It is principally remarkable for the breed of ſaddle-horſes which cannot be reared in Norfolk, though many attempts have been made for that purpoſe. Yorkſhire ſtallions are frequently ſent into Norfolk; but though the foals may be handſome when young, they loſe their beauty when old. In Yorkſhire, on the other hand, though the foal be ever ſo unpromiſing, it acquires beauty, ſtrength, and activity as it grows up. Mr Marſhal ſuppoſes that from five to ten thouſand horſes are annually bred up between the eaſtern Morelands and the Humber.

"Thirty years ago (ſays Mr Marſhal), ſtrong ſaddle-horſes, fit for the road only, were bred in the Vale; but now the prevailing breed is the faſhionable coach-horſe, or a tall, ſtrong, and over-ſized hunter; and the ſhows of ſtallions in 1787 were flat and ſpiritleſs in compariſon with thoſe of 1783." The black cart-horſe, an object of Mr Marſhal's peculiar averſion, is alſo coming into the Vale.

In the breeding of horſes he complains greatly of the negligence of the Yorkſhire people, the mares being almoſt totally neglected; though in the brute creation almoſt every thing depends upon the female.

Lanarkſhire breed of horſes.

Of late years a very valuable breed of horſes has been reared in the upper part of Clydeſdale or Lanarkſhire.

ſhire. They are of a middle ſize, well ſhaped, and extremely active. They are not fit for a very heavy draught; but the very quick ſtep which they poſſeſs gives them a decided preference for the uſe of the plough upon well cultivated lands, as they are capable of going over an immenſe quantity of ground in a ſhort time, where the draught is not ſevere. The ſame qualities render them highly uſeful for the ordinary purpoſes of farm-work. They are rapidly ſpreading over all parts of the country, and have found their way into the north of England, where they are greatly valued. In the ſame part of the country, a larger breed has alſo of late been encouraged, which adds very conſiderable ſtrength or power to the activity of the former kind. They are in great requeſt about Glaſgow and other manufacturing towns. Their uſual draught is a load of about 24 cwt. in addition to the cart on which the load is placed. Different Kinds of Horſes.

With regard to the general maintenance of horſes, we have already mentioned ſeveral kinds of food upon which experiments have been made with a view to determine the moſt profitable mode of keeping them. Perhaps, however, the moſt certain method of aſcertaining this matter is by obſerving the practice of thoſe counties where horſes are moſt in uſe. Mr Marſhal recommends the Norfolk management of horſes as the cheapeſt method of feeding them practiſed anywhere; which, however, he ſeems willing to aſcribe in a great meaſure to the excellency of their breed. In the winter months, when little work is to be done, their only rack-meat is barley-ſtraw; a reſerve of clover-hay being uſually made againſt the hurry of ſeed-time. A buſhel of corn in the moſt buſy ſeaſon is computed to Norfolk management of horſes recommended.

Different Kinds of Horſes.

be an ample allowance for each horſe, and in more leiſure times a much leſs quantity ſuffices. Oats, and ſometimes barley, when the latter is cheap and unſaleable, are given; but in this caſe the barley is generally malted, i. e. ſteeped and afterwards ſpread abroad for a few days, until it begin to vegetate, at which time it is given to the horſes, when it is ſuppoſed to be leſs heating than in its natural ſtate. Chaff is univerſally mixed with horſe-corn: the great quantities of corn grown in this county afford, in general, a ſufficiency of *natural chaff*; ſo that *cut chaff* is not much in uſe: the chaff, or rather the awns of barley, which in ſome places are thrown as uſeleſs to the dunghill, are here in good eſteem as provender. Oat chaff is deſervedly conſidered as being of much inferior quality.—It may here be remarked, that this method of keeping horſes, which Mr Marſhal approves of in the Norfolk farmers, is practiſed, and probably has been ſo from time immemorial, in many places of the north of Scotland; and is found abundantly ſufficient to enable them to go through the labour required. In ſummer they are in Norfolk kept out all night, generally in clover leys, and in ſummer their keep is generally clover only, a few tares excepted.

This method followed in many places in Scotland.

Calculations of the expence of keeping horſes.

In the fourth volume of the Annals of Agriculture, Mr Young gives an account of the expence of keeping horſes; which, notwithſtanding the vaſt numbers kept in the iſland, ſeems ſtill to be very indeterminate, as the informations he received varied no leſs than from 8l. to 25l. a-year. From accounts kept on his own farm of the expence of horſes kept for no other purpoſe than that of agriculture, he ſtated them as follows:

1763,

Different Kinds of Horſes.

	L.	s.	d.
1763, Six horſes coſt per horſe -	10	13	0
1764, Seven do. - -	8	10	11
1765, Eight do. - - -	14	6	6
1766, Six do. - - -	12	18	9

Average on the whole 11l. 12s. 3d.

By accounts received from *Northmins* in Herefordſhire, the expences ſtood as follows:

	L.	s.	d.
1768, Expence per horſe -	20	7	0
1769, - - -	15	8	5
1770, - - -	14	14	2
1771, - - -	15	13	3
1772, - - -	18	4	0
1773, - - -	15	11	8
1774, - - -	14	4	5
1775, - - -	19	0	5
1776, - - -	16	14	5

Average 16l. 13s. 1d.

On theſe diſcordant accounts Mr Young obſerves, undoubtedly with juſtice, that many of the extra expences depend on the extravagance of the ſervants; while ſome of the apparent ſavings depend either on their careleſſneſs, or *ſtealing* provender to their beaſts privately, which will frequently be done. He concludes, however, as follows: "The more exactly the expence of horſes is examined into, the more advantageous will the uſe of oxen be found. Every day's experience convinces me more and more of this. If horſes kept for uſe alone, and not for ſhow, have proved thus expenſive to me, what muſt be the expence to thoſe farmers who

Different Kinds of Horſes.

make their fat ſleek teams an object of vanity? It is eaſier conceived than calculated.

Uſe of roots for feeding horſes.

It muſt be obſerved, however, that the above trials or accounts are of an old date; and that during the late dearth a variety of experiments were made, which ſhew that horſes may be ſucceſsfully fed, even when engaged in hard labour, with other articles than grain. With this view, different roots have been given them as ſubſtitutes; and a great ſaving has been experienced, attended with no loſs of labour or diſadvantage to the animal: ſo that the continuance and extenſion of this ſyſtem is a matter of much importance to the public. The articles that have been chiefly employed are turnips, roota baga, potatoes, carrots, &c.—Turnips have been given in a raw ſtate, withholding about one half of the uſual allowance of corn, and in moſt inſtances the animals have done their work well, and appeared in good condition. When the roota baga has been uſed, little or no grain has been neceſſary, and the other roots already mentioned have been ſucceſsfully uſed even in a raw ſtate; but when potatoes, yams, roota baga, &c. are boiled, which has ſometimes been done, it does not appear that grain is at all neceſſary. It is to be obſerved, that young horſes eat theſe roots readily and with great reliſh; and that during the winter, with them and a ſmall portion of dry food, they are kept in as good condition and ſpirit as when fed upon graſs during the ſummer. This is a matter of much importance to young animals, as it muſt contribute greatly to their growth and future ſtrength. Whereas, in a great majority of caſes, when reared without the aid of theſe roots, they are fed in winter, when ſubſtantial food is moſt neceſſary to ſupport them againſt the ſeverity of the weather, in

ſuch

ſuch a manner as to be barely kept alive. During the winter months their growth is thus ſtopt; they loſe the little fleſh they had acquired during the preceding ſummer, become ſtunted and hide-bound, and, when the ſpring arrives, they are in ſo miſerable a ſtate, that a conſiderable part even of the ſummer elapſes before they can reſume their growth. In this way, four or five years are required to bring them to the ſize that others of the ſame ſpecies attain in half that time under different management. Different Kinds of Horſes.

In a letter to Mr Young, Mr George Culley expreſſes himſelf thus, with regard to the utility of potatoes as food for horſes*. "I am happy to remark, that we have practiſed giving our work-horſes potatoes for ſeveral years in the ſpring with the greateſt ſucceſs. I do not pretend to ſay, that we do not give corn to our horſes at the ſame time, becauſe it is a ſeaſon that we work our horſes remarkably hard. But we are inclined to think, that the giving potatoes along with their corn and ſtraw (for we often have not hay at that ſeaſon to ſpare), not only keeps them heartier, but prevents greaſe, which we uſed to be frequently accuſtomed to amongſt our horſes at that ſeaſon. And we apprehend by thoſe valuable roots keeping them cool, and open in their bodies, is the means of preventing greaſe, foulneſs, and many diſorders, our horſes uſed to be ſubject to. I am very ſenſible, that carrots are better for horſes than potatoes; but then we can raiſe the latter at much leſs expence than the former, and they are more eaſily preſerved in pits or ſtacks." Potatoes for feeding horſes.

* *Annals of Agriculture*, vol. xxi.

Different Kinds of Horſes.

Mr Young alſo informs us *, that in France, in the neighbourhood of Breſt, where they have a great pride in rearing fat horſes; they fatten numbers of them by feeding them with cabbages and parſnips boiled together, and mixed with buck-wheat flour, and given warm.

Carrots for horſes.

One uncommon excellence, ſaid to attend the uſe of carrots in feeding horſes † is this, that they are accounted a cure for broken-winded horſes: by common work they do not ſeem to be at all affected; and for thoſe with only bad, or, as it is called, *thick* wind, they are an entire cure for the time they feed on them. Any green food in winter has a ſimilar, though not an equal effect. It is obſerved abroad of cheſnuts.

In addition to the uſe of roots, it is of importance to reduce the great expence of horſe-keeping, in the opinion of Mr Young ‡, "never to turn them out in ſummer, but to ſoil them conſtantly in the ſtable or yard with lucern, tares, or clover; the firſt is by much the beſt, as it laſts through the ſix months, and yields very ample crops when well managed: in this method the crop, whatever it is, goes trebly as far as when fed in the field; and if the team is well littered, the dung-hill will almoſt pay the expence of their keeping. By this practice alſo the evil is avoided of feeding paſtures and meadows with horſes, which injure them more by their unequal feeding than many perſons are aware of, but the ox improves the field."

---

* *Travels*, vol. ii.

† *Annals of Agriculture*, vol. xxxvi.

‡ Vol. xxxvi.

SECT.

Breeding and Rearing of Black Cattle.

SECT. III.

OF THE BREEDING AND REARING OF BLACK CATTLE.

THESE are reared for two different purpoſes; viz. work, and fattening for ſlaughter. For the former purpoſe, Mr Marſhal remarks, that it is obviouſly neceſſary to procure a breed without horns. This he thinks would be no diſadvantage, as *horn*, though formerly an article of ſome requeſt, is now of very little value. The horns are quite uſeleſs to cattle in their domeſtic ſtate, though nature has beſtowed them upon them as weapons of defence in their wild ſtate; and our author is of opinion, that it would be quite practicable to produce a hornleſs breed of black cattle as well as of ſheep, which laſt has been done by attention and perſeverance; and there are now many hornleſs breeds of theſe creatures in Britain. Nay, he inſiſts, that there are already three or four breeds of hornleſs cattle in the iſland; or that there are many kinds of which numbers of individuals are hornleſs, and from theſe, by proper care and attention, a breed might be formed. The firſt ſtep is to ſelect females; and having obſerved their imperfections, to endeavour to correct them by a well choſen male. A hornleſs breed of black cattle deſirable for work.

The other properties of a perfect breed of black cattle for the purpoſes of the dairy as well as others, ought, according to Mr Marſhal, to be as follow: Properties requiſite in black cattle.

1. The head ſmall and clean, to leſſen the quantity of offal. 2. The neck thin and clean, to lighten the fore-

Breeding and Rearing of Black Cattle.

end, as well as to leſſen the collar, and make it fit cloſe and eaſy to the animal in work. 3. The carcaſe large, the cheſt deep, and the boſom broad, with the ribs ſtanding out full from the ſpine; to give ſtrength of frame and conſtitution, and to admit of the inteſtines being lodged within the ribs. 4. The ſhoulders ſhould be light of bone, and rounded off at the lower point, that the collar may be eaſy, but broad to give ſtrength; and well covered with fleſh for the greater eaſe of draught, as well as to furniſh a deſired point of fatting cattle. 5. The back ought to be wide and level throughout; the quarters long; the thighs thin, and ſtanding narrow at the round bone; the udder large when full, but thin and looſe when empty, to hold the greater quantity of milk; with large dug-veins to fill it, and long elaſtic teats for drawing it off with greater eaſe. 6. The legs (below the knee and hock) ſtraight, and of a middle length; their bone, in general, light and clean from fleſhineſs, but with the joints and ſinews of a moderate ſize, for the purpoſes of ſtrength and activity. 7. The fleſh ought to be mellow in the ſtate of fleſhineſs, and firm in the ſtate of fatneſs. 8. The hide mellow, and of a middle thickneſs, though in our author's opinion this is a point not yet well determined.

Properties ſtated by Mr Young.

Mr Young enumerates the properties of cattle intended for feeding, which do not ſeem to differ eſſentially from thoſe already ſtated. "Firſt, The beaſt ſhould be ſhort-legged. This is an important point in his ſhape, ſince few very ſhort-legged ones will be, upon the whole, ill-made beaſts.

"Next, The back ſhould be very ſtraight. In the beſt beaſts, the backs are as ſtraight as an arrow, without

out the leaſt ſinking or riſing in any part; and alſo very broad and very flat. Breeding and Rearing of Black Cattle.

"Thirdly, The carcaſe ſhould be round, and as nearly the ſhape of a barrel as is conſiſtent with one line, (the back) be ng quite ſtraight.

"Fourthly, The fore-quarters ſhould, for the ſame reaſon, be round, full and ſpreading, in order that the fore end of the barrel may be as large as the hinder end

"Fifthly, The neck and throat clean, with little or no dewlap.

"Theſe are ſome among many points. Mr Bakewell laid great ſtreſs on the merit of his breed fattening on the beſt joints, and exhibited an ox at London, whoſe rump was perfectly monſtrous with fat, while the ordinary joints were by no means equally fat; and, when we conſider, that there is a difference of a penny and three half pence a pound in different joints, this certainly ſeems to be a ſound doctrine.

"A curled, inſtead of a ſtraight haired hide, is a ſign of a thriving beaſt; and in various inſtances of beaſts that I have fattened myſelf, I have obſerved it to be a point of importance. They have remarked the ſame thing in Scotland. A lean beaſt alſo, with a curled hide, will generally keep himſelf in better order than another."

It is to be obſerved, however, that a man would judge and act very unſafely, who in the purchaſe of cattle intended to be fattened ſhould truſt to his eye alone. A ſtill more important object perhaps is, that the ſkin, when handled, ſhould feel ſoft and ſilky; hence, in chooſing cattle, with a view to convert their food into the largeſt ſum of money per ton, a very principal

Breeding and Rearing of Black Cattle.

cipal ſhare of attention ought to be given to the feel or touch. The opinion upon this ſubject of Mr George Culley is the reſult of extenſive practice and accurate obſervation. He recommends cattle whoſe ſkins feel ſoft or mellow: He alſo ſays, "indeed it is the nice touch or feel of the hand which, in a great meaſure, conſtitutes the judge of cattle.

Mr Young obſerves, that "heifers ſpayed in general fatten better and quicker than oxen, but they are not to be had with equal certainty.

"Dry and old cows are fattened in ſome places in great numbers; but the riſk of all ſorts is greater; ſo that, notwithſtanding their being ſometimes very profitable, oxen are to be preferred. Cows ſhould take the bull before they are fattened, but they ſhould be fat three months before the time of calving.

"Oxen that have been worked are preferred all over England by the graziers: they not only fat kindlier than others, but make the beſt beef. Mr Middleton of Suffolk killed an ox that worked even till fourteen years old, and the beef proved excellent. This is a manifeſt proof of the benefit of working, ſince we are told that ſixteen years is the common life of an ox.

Food for cattle.

Concerning the proper food of cattle, we account it unneceſſary to make any remarks in addition to thoſe already ſtated in different parts of our work. It may be proper to obſerve, however, that every farmer or grazier who wiſhes to conduct his buſineſs to advantage, ought ſo to arrange his affairs, and the ſtock of food that he provides for his cattle, as to have it in his power to keep them on hand during the winter, and to ſell them when meat ſells deareſt; that is, from the firſt of March to the firſt of June. At this period he will not

Breeding and Rearing of Black Cattle.

not only obtain a better price than in autumn, but his ſtock will go off freely, and every change of markets will be in his favour. He will alſo obtain the largeſt poſſible command of manure. In accompliſhing this object the great difficulty conſiſts of providing a ſufficient ſtore of winter food. Upon the quantities of ſuch food neceſſary for fattening cattle, we ſhall take notice of ſome remarks made by Mr Young *.

"1. *Oil-cake.*—There is no article in the food of an ox which has hitherto been found to equal this in the fattening quality.

"It is the cake of linſeed, not rape. While beef ſells at 4d. a pound, and the cake is to be bought at 4l. per ton, there is a conſiderable profit to be made by uſing it, ſuppoſing the price of the animal lean is upon the par of good times. But this food has riſen of late years to ſo high a price, that no other benefit can be made by uſing it than what ariſes from the dung.

"It is to be noted, that whatever food is uſed principally, yet that hay is always to be ſuppoſed; for whether oil-cake, cabbage, or roots, be the food, it has been found profitable to allow the beaſt from half a ſtone to a ſtone of hay *per diem.* Mr Moody of Retford in Nottinghamſhire gives a beaſt of a hundred ſtone two cakes a day, each 6lb. for the firſt two months, and then three a day till fat.

In November and December	120 cakes	
To end of March	270	
	390 at 6lb.	is 21 cwt.
		21 cwt.

* *Annals of Agriculture*, vol. xxxii.

Breeding and Rearing of Black Cattle.

21 cwt. at 4l. 10s. per ton is -	L.4	14	6
20lb. hay per day, 1 ton 6. cwt. at 40s.	2	12	0
To winter fatting ſuch a beaſt -	7	6	6

"On the ſame principle as cake-feeding, ſome perſons have tried, and it is ſaid with ſucceſs, linſeed oil (at 3s. 6d. a gallon) and bran. For ſmall cattle two pecks each of bran a day, divided into three feeds, and into each peck half a pint of oil well mixed. Alſo mixtures of bran, malt combs, and peaſe or other meal; but all theſe foods muſt depend on price.

" Oil-cakes for this purpoſe have alſo been boiled, it is ſaid with ſucceſs.

" 2. *Carrots.*—Next to oil-cake this root fattens an ox better than any other food; ſtill, however, he muſt be allowed a portion of good hay in addition. Of this ſort of root, an ox will eat ſomething better than a ſeventh of his own weight every day—ſuppoſe we ſay a ſixth; conſequently a beaſt of 60 ſtone will eat 10 ſtone of carrots; and as an acre will yield 400 buſhels or 22,400lb. it would ſupport ſuch an ox 160 days or between five and ſixth months; a period too long for beaſts to be kept that have had the ſummer's graſs. If they are half fat, when put to carrots, an acre would fatten two ſuch beaſts.

" 3. *Cabbages*, for this purpoſe, are alſo an admirable plant; from many experiments made by various gentlemen of acknowledged accuracy, it has been found, that an ox will eat ſomething leſs *per diem* than a fifth of his own weight.

" 4. *Turnips*, though the moſt common article of winter food, are inferior to any of the preceding: they are much more liable to accidents and diſtempers,

and conſequently can be little depended on; nor have they the fattening quality in an equal degree. A beaſt will eat from a third to half his own weight of theſe every day: an acre of 25 tons will therefore fatten a beaſt of 60 ſtone or ſomething more. There is no occaſion to ſlice them." Breeding and Rearing of Black Cattle.

The ſame writer takes notice of ſome of the more ordinary diſeaſes to which cattle are liable, the remedies for which ought to be generally known. Diſeaſes of cattle.

"The *garget*.—This diſeaſe is an obſtruction in the bag, owing to not being clean milked: an internal tumour grows into a hard knot, and it is commonly attended with the loſs of one or two teats, and ſometimes more. When a cow is infeſted with it, ſhe ſhould be dried for fattening, which is better than attempting the cure of a diſeaſe which, of any ſtanding, is incurable. Great care and attention ſhould, therefore, be uſed to have the milkers do their buſineſs clean. Cows that are ſuckled are much leſs liable to this diſtemper than thoſe that are milked: and when firſt they are attacked with it, a good way is to have the cow ſucked for ſome time, ſtroking clean after the calf.

"*The fever*.—Whether the diſeaſe, which the farmers term a fever, is really one, I do not know; but ſhould much queſtion it from the warmth of the cordials given, and with ſucceſs. It deſerves rather to be called a *cold*, and uſually proceeds from catching cold in, or ſoon after, calving. I have given Brackin's cordial ball, diſſolved in a pint of warm ale, with ſucceſs. The cow ſhould be confined, and have only hay and warm water, with a warm malt maſh at night.

"*Looſeneſs*.—Give ſalt and powdered chalk in equal quantities;

Breeding and Rearing of Black Cattle.

quantities; a large ſpoonful of the mixture twice a day, and keep her to dry meat.

"*Hoving*, or ſwelling from eating very ſucculent plants, particularly clover. One remedy is to drive them very ſeverely about, and doſe them with ſalt and water pretty ſtrong, half a pint or a pint at a time. Stabbing is a much more effectual cure with thoſe who have had experience enough to practiſe it. A lancet-pointed knife, with a haft that prevents its entering more than four inches into the paunch ſhould be kept in readineſs. The blow is given exactly between the ſhort ribs and hip-bone."

Dr Monro's cure for ſwelled cattle.

As this laſt frequently occurs, and is attended with very fatal conſequences, we ſhall here ſtate ſome other remedies. A correſpondent of Mr Young, partly upon authority of a work entitled *Rawlin's Cow-Doctor*, and partly upon his own authority, makes the following remarks *: "As many black cattle are loſt in conſequence of the ſwelling occaſioned by their having eaten red clover and other ſoft and ſucculent graſs, potatoes, grain, oil-cakes, &c. the celebrated Dr Monro, profeſſor of anatomy in Edinburgh, invented a flexible tube for the ſole purpoſe of remedying this violent and dangerous diſeaſe, with the greateſt ſafety, eaſe, and deſpatch; which invention he has for many years mentioned in the courſe of his Anatomical Lectures; but, from its not being generally known, the advantages which would immediately ariſe from it, are loſt to the greateſt part of the community, to whom it might be of ſervice.

"Dr

* *Annals of Agriculture*, vol. xxix.

Breeding and Rearing of Black Cattle.

"Dr Monro begins by obſerving, that the ſwelling of the belly is owing to the diſtenſion of the ſtomachs, and particularly of the firſt ſtomach, by fixed air, which is diſengaged from the tender and ſucculent graſs, &c. in conſequence of its ſolution and violent fermentation; while the diſcharge of it afterwards through the gullet ſeems to be prevented by a ſpaſm, or muſcular contraction of the upper orifice of the ſtomach. He next remarks, that the dangerous and often fatal effects, which follow the diſtenſion, are not owing to the fixed air nor to the juices of the fermented graſs, acting as poiſonous upon the ſtomach, as a moderate quantity of either produces no bad effects; and that the repeated experience of the grazier has ſhown, that many cattle are immediately relieved and preſerved by ſtabbing them with a knife, and thus allowing the air to eſcape. He therefore concludes, that cattle may with certainty be ſaved, if the air be drawn off in due time, without injuring the ſtomach or other bowels; and he affirms, that this may be done with great eaſe, by paſſing a flexible tube from the mouth down the gullet into the ſtomach.

"The tube is to be compoſed of iron wire, of about one-ſixteenth of an inch diameter, twiſted round a ſmooth iron rod three-eighths of an inch diameter, in order to give it the cylindrical form; and, after taking it off the rod, it is to be covered with ſmooth leather. To the end of the tube, which is intended to be paſſed into the ſtomach, a braſs pipe two inches long, of the ſame ſize, or ſomething larger than the tube, and pierced with a number of large holes, is to be firmly connected. To prevent the tube from bending too much within the mouth or gullet in the time of paſſing it down into the ſtomach,

Breeding and Rearing of Black Cattle.

ſtomach, an iron wire, one-eighth of an inch diameter, and of the ſame length as the tube, is put within it; which is to be withdrawn when the tube has entered the ſtomach. He has found that the ſpace from the fore-teeth to the bottom of the firſt ſtomach of a large ox meaſures about ſix feet: and he has paſſed ſuch a tube, five feet nine inches long, into the gullet of a living ox. The tube ought therefore, to be ſix feet long, that we may be ſure of its anſwering in the largeſt ox.

"After the tube is paſſed into the ſtomach, it may be allowed to remain for any length of time, as it does not interrupt the breathing of the animal. The greater part of the elaſtic and condenſed air will be readily diſcharged through the tube; and, if it be thought neceſſary, ardent ſpirits, or any other fluid fit for checking fermentation, or which may be uſeful in other reſpects, can be injected through ſuch a tube into the ſtomach.

"By means of ſuch a tube the air is not only more certainly diſcharged than by ſtabbing the animal; but the danger is avoided, which the ſtabbing occaſions, not ſo much by the irritation which the wound creates, as that the air and the other contents of the ſtomach, getting into the cavity of the belly between the containing parts and the bowels, excite ſuch a degree of inflammation as frequently proves fatal to the animal.

"This flexible tube has been found of infinite ſervice in ſaving the lives of ſheep when attacked by ſimilar diſorders, or any other ſwelling peculiar to that animal.

"The inſtrument above deſcribed is ſo ſimple and

eaſy

eaſy to make, that I ſhould imagine any common workman would be equal to the undertaking. Mine was made by James M'Dowal, N° 15. Great Windmill-ſtreet, London, who is a very ingenious mechanic in every thing relating to agriculture." Breeding and Feeding of Black Cattle.

In the ſame work the following remedy is ſtated, upon the authority of an anonymous correſpondent. "Three quarters of a pint of olive oil; one pint of melted butter or hogs-lard: Give it to the beaſt with a horn or bottle; and, if not better in a quarter of an hour, repeat the ſame quantity. Walk the animal gently about.—The doſe for a ſheep, a wine-glaſs and half to two glaſſes. Another cure for ſwelled cattle.

"The effects of this ſimple medicine are hardly to be conceived till tried. The firſt doſe generally performs a cure, which is perceived almoſt as ſoon as the animal has ſwallowed it, by its breaking wind, and the ſubſiding of its ſides."

A ſtill ſimpler remedy than any of theſe is now uſed in ſome parts of the country, with ſuch entire ſucceſs, that it ought to be generally known. It conſiſts of filling an egg-ſhell with tar, and immediately putting it down the throat of the animal. The ſtimulating effect of the tar immediately removes the ſpaſms that appear to affect the upper and lower orifices of the ſtomach of the animal. A ſimpler remedy.

For the cure of what are called the *dry murrain* and *bloody urine*, the following remedies, which appear to be judicious, are ſtated as ſucceſsful by an anonymous writer in the Farmers Magazine. "I have frequently given to cattle, labouring under the firſt of theſe diſorders, large quantities of boiled turnips mixed with butter, caſtor oil, and other powerful laxative medicines, and alſo Dry murrain.

Breeding and Feeding of Black Cattle.

ſome injections, without being able to produce the deſired effect. After having employed ſeveral cow-doctors, and loſing ſeveral beaſts by this ſevere diſorder, I determined (after having in vain given at the mouth conſiderable quantities of the above laxatives), to give the under-mentioned ſtrong injection, which, in the courſe of ſix or eight hours, produced a very copious diſcharge of dung. Apprehending danger from the greatneſs of the diſcharge, I uſed grated wheaten bread boiled in water, and water and wheat-meal boiled together; which, in the courſe of a few days, ſufficiently checked the diſcharge. During the illneſs, the beaſt ſhould be kept moderately warm, and have warm water, and afterwards *oat-meal* and *water* for ſeveral days. I have found that cattle are leaſt ſubject to this diſorder, when ſome turnips are given with their fodder. The injection I uſed was three pints of common gruel, four ounces of Epſom ſalts, half a gill of tincture of ſenna, and half a gill of olive oil well mixed. Laxative medicines given at the mouth, and bleeding to prevent inflammation, are alſo neceſſary. If the firſt glyſter does not produce the deſired effect, a repetition of it will ſeldom fail to effect a cure.

Bloody urine.

In the *bloody urine*, adds this author, I never, except in one inſtance, when the delay was too long, knew the following method prove abortive. As ſoon as the bloody urine is obſerved, the animal ſhould be houſed; immediately afterwards let a pint of common ſea-ſalt be diſſolved in cold water (as much as is neceſſary to hold it in ſolution); and given at the mouth. A few hours afterwards the animal will have a great inclination to drink, and large quantities of clear cold water ſhould be offered. If it will not voluntarily drink a great conſiderable

ſiderable quantities ſhould from time to time be adminiſtered by force, till the urine turn to its natural colour, which it will generally do in the courſe of 24 to 30 hours. Inſtead of the ſalt and water, I have, with equal ſucceſs, uſed about a gallon of milk well ſtrained, after a conſiderable quantity of old ruſty iron had been heated red-hot, and put into it. If the quantity of iron be ſufficient, the thirſt will be very great, which ſhould be ſatisfied as above. I apprehend, that in this diſorder the greateſt danger proceeds from exceſſive heat or fever, bringing a kind of murrain or ſtoppage of dung, provincially "the feather cling." To obviate or remove this, I have always found, that a few ounces of Locatelle's balſam, given at the mouth, is effectual. It generally takes place within a day or two after the other diſorder ceaſes." Breeding and Feeding of Black Cattle.

As the milk of cows is always an article of great importance, it becomes an object to the huſbandman, if poſſible, to prevent the waſte of that uſeful fluid, which, in the common way of rearing calves, is unavoidable. A method of bringing up theſe young animals at leſs expence was at one time propoſed by the duke of Northumberland. His plan was to make ſkimmed milk anſwer the purpoſe of that which is newly drawn from the teat; and which, he ſuppoſed, might anſwer the purpoſe at one-third of the expence of new milk*. The articles to be added to the ſkimmed milk are treacle and the common linſeed oil-cake ground very fine, and almoſt to an impalpable powder, the quantities of each being ſo ſmall, that to make 32 gallons would coſt only Of rearing calves without milk.

* *Annals of Agriculture*, vol. i. p. 296.

Breeding and Feeding of Black Cattle.

6d. beſides the ſkimmed milk. It mixes very readily and almoſt intimately with the milk, making it more rich and mucilaginous, without giving it any diſagreeable taſte. The receipt for making it is as follows: Take one gallon of ſkimmed milk, and to about a pint of it add half an ounce of treacle, ſtirring it until it is well mixed; then take one ounce of linſeed oil-cake finely pulverized, and with the hand let it fall gradually in very ſmall quantities into the milk, ſtirring it in the mean time with a ſpoon or ladle until it be thoroughly incorporated; then let the mixture be put into the other part of the milk, and the whole be made nearly as warm as new milk when it is firſt taken from the cow, and in that ſtate it is fit for uſe. The quantity of the oil-cake powder may be increaſed from time to time as occaſion requires, and as the calf becomes inured to its flavour.

Mr Young's experiments.

On this ſubject Mr Young remarks, that in rearing calves, there are two objects of great importance: 1. To bring them up without any milk at all; and, 2. To make ſkimmed milk anſwer the purpoſe of ſuch as is newly milked or ſucked from the cow. In conſequence of premiums offered by the London Society, many attempts have been made to accompliſh theſe deſirable purpoſes; and Mr Budel of Wanborough in Surrey was rewarded for an account of his method. This was no other than to give the creatures a gruel made of ground barley and oats. Mr Young, however, who tried this method with two calves, aſſured us, that both of them died, though he afterwards put them upon milk when they were found not to thrive. When in Ireland he had an opportunity of purchaſing calves at three days old from 20d. to 3s. each; by which he was reduced

to

to repeat the experiment many times over. This he did in different ways, having collected various receipts. In conſequence of theſe he tried hay-tea, bean-meal mixed with wheat-flour, barley and oats ground nearly, but not exactly, in Mr Budd's method: but the principal one was flax-ſeed boiled into a jelly, and mixed with warm water; this being recommended more than all the reſt. The reſult of all theſe trials was, that out of 30 calves only three or four were reared; theſe few were brought up with barley and oat-meal and a very ſmall quantity of flax-ſeed jelly, one only excepted, which, at the deſire of his coachman, was brought up on a mixture of two thirds of ſkimmed milk and one-third of water, with a ſmall addition of flax-jelly well diſſolved. Breeding and Feeding of Black Cattle.

The ſecond object, viz. that of improving ſkimmed milk, according to the plan of the duke of Northumberland, ſeems to be the more practicable of the two. Mr Young informs us, that it has anſwered well with him for two ſeaſons; and two farmers to whom he communicated it gave likewiſe a favourable report.

In the third volume of the ſame work, we are informed, that the Cornwall farmers uſe the following method in rearing their calves. "They are taken from the cow from the fourth to the ſixth day; after which they have raw milk from ſix to ten or fourteen days. After this, they feed them with ſcalded ſkimmed milk and gruel made of ſhelled oats, from three quarts to four being given in the morning, and the ſame in the evening. The common family broth is thought to be as good, or better, than the gruel, the ſavour of the ſalt being ſuppoſed to ſtrengthen their bowels. The propor- Method of rearing calves in Cornwall.

Breeding and Feeding of Black Cattle.

tion of gruel or broth is about one-third of the milk given them. A little fine hay is ſet before them, which they ſoon begin to eat.

Mr Crook's method.

In the 5th volume of Bath Papers, we have an account by Mr Crook of a remarkably ſucceſsful experiment on rearing calves without any milk at all. This gentleman, in 1787, weaned 17 calves; in 1788, 23; and in 1789, 15. In 1787, he bought three ſacks of linſeed, value 2l. 5s. which laſted the whole three years. One quart of it was put to ſix quarts of water; which, by boiling 10 minutes, was reduced to a jelly: the calves were fed with this, mixed with a ſmall quantity of tea, made by ſteeping the beſt hay in boiling water. By the uſe of this food three times a-day, he ſays, that his calves throve better than thoſe of his neighbours, which were reared with milk. Theſe unnatural kinds of food, however, are in many caſes apt to produce a looſeneſs, which in the end proves fatal to the calves. In Cornwall, they remedy this ſometimes by giving acorns as an aſtringent; ſometimes by a cordial uſed for the human ſpecies, of which opium is the baſis.

Norfolk method, &c.

In Norfolk, the calves are reared with milk and turnips; ſometimes with oats and bran mixed among the latter. Winter calves are allowed more milk than ſummer ones; but they are univerſally allowed new milk, or even to ſuck. In the midland counties bull-calves are allowed to remain at th[illegible] until they be ſix, nine, or twelve months old, letting them run either with their dams or with cows of leſs valu[illegible] bought on purpoſe. Each cow is generally allowed one male or two female calves. Thus they grow very fat, and become ſurpriſingly vigorous. The method of the dairy-

men

men is to let the calves ſuck for a week or a fortnight, according to their ſtrength; next they have new milk in pails for a few meals; after that, new and ſkimmed milk mixed; then ſkimmed milk alone, or porridge made with milk, water, ground oats, &c. ſometimes with oil-cake, &c. until cheeſe-making commences; after which they have whey-porridge, or ſweet whey in the field, being carefully houſed in the night until the warm weather come in. Breeding and Feeding of Black Cattle.

A late intelligent Scotiſh clergymen, Mr John Bradfute of Dunſyre, once or twice ſucceſsfully made trial of treacle, as a food by means of which to rear calves without the aid of any kind of milk. He uſed it diluted with common water, and ſometimes with what is called *hay-tea*, that is to ſay, water in which hay had been boiled. The whole expence of the treacle neceſſary to bring a calf the length of uſing common food was at that time (16 years ago) about 4s. 6d. The animals came forward well, and enjoyed good health; but they grew much to the bone, and did not fatten for a conſiderable time. Mr Bradfute's mode.

"During the firſt five or ſix weeks of their lives young calves very frequently die of a diſeaſe called the *chords*, which uſually comes on with a trembling fit, and appears to be of an inflammatory nature. The following mode of preventing it is recommended by an anonymous writer*: "How ſoon the mother gets a little reſt after calving, ſhe is milked, and a little of the milk given to the calf as early as poſſible. If the weather is cold, and the mother long in giving milk, it is taken to the fire, Diſeaſe called the *chords*.

* *Farmers Magazine*, Auguſt 1803.

Breeding and Feeding of Black Cattle.

and warmed in a pan until it is blood warm, and then given to the calf, about ſix or eight gills, according to the ſize of the calf, and repeated four times in 24 hours. As the calf gathers ſtrength, the quantity may be increaſed; but too much of the milk at one time is as bad as too little, until it is a month or ſix weeks old. When the calf is able to ſtand, I tie it to a ſtake, as it is more in the power of the ſervant to give it milk in that ſituation than when going about looſe. If a calf gets cold milk, it is ſure to bring on a trembling, and the chords or ſome other malady follows, which I have often ſeen exemplified amongſt the young ſtock of my neighbours. The above has been my ſcheme of rearing calves, and I never had one died of the chords, if fed in this way and kept dry."

Cattle are paſtured,

For feeding cattle, two modes of practice have been propoſed, and in ſome ſituations adopted; the one mode, which is the moſt ancient, and the moſt extenſively practiſed in agricultural countries, conſiſts of turning out the cattle during the whole ſeaſon that any food for them can be found on the ground, and of taking them into the houſe during the ſeverity of winter, and of feeding them with ſuch articles as can be moſt conveniently procured in the climate and ſituation, ſuch as, ſtraw or hay of different kinds, and roots.

or ſtall fed.

The other mode which has been adopted to ſome extent by huſbandmen in German[illegible]at times alſo in our own great towns, by perſons called *cow-feeders*, who ſupply the inhabitants with milk, is called the ſyſtem of ſtall-feeding. It conſiſts of keeping the cattle continually in the houſe at every ſeaſon of the year, and of feeding them there. If they are confined,

and

and fed with green food in a yard on which abundance of litter is ſpread, it is in England called *ſoiling*. By many German writers upon rural economy, this ſyſtem is highly approved of, as affording the means of drawing the higheſt poſſible produce from every portion of the land, and as employing a great number of hands in the uſeful occupations of huſbandry. In a communication to the Board of Agriculture from A. Thaer, M. D. phyſician of the electoral court of Hanover, the advantages of this ſyſtem are ſaid to be founded upon the following incontrovertible principles:

Breeding and Feeding of Black Cattle.

Stall-feeding in Germany.

" 1. A ſpot of ground which, when paſtured upon, will yield ſufficient food for only one head, will abundantly maintain four head of cattle in the ſtable, if the vegetables be mowed at a proper time, and given to the cattle in a proper order.

" 2. The ſtall-feeding yields at leaſt double the quantity of manure from the ſame number of cattle; for the beſt and moſt efficacious ſummer manure is produced in the ſtable, and carried to the fields at the moſt proper period of its fermentation, whereas, when ſpread on the meadow, and exhauſted by the air and ſun, its power is entirely waſted.

" 3. The cattle uſed to ſtall-feeding will yield a much greater quantity of milk, and increaſe faſter in weight when fattening than when they go to the field.

" 4. They are leſs ſubject to accidents, do not ſuffer by the heat, by flies and inſects, are not affected by the baneful fogs which are frequent in Germany, and bring on inflammations: on the contrary, if every thing be properly managed, they remain in a conſtant ſtate of health and vigour."

It is added that a ſufficient, or rather plentiful ſupply

Breeding and Feeding of Black Cattle.

ply of food for one head of cattle daily, if kept in a ſtable, conſiſts upon an average of 130 pounds of green, or 30 pounds of dry clover, which anſwers the ſame purpoſe. Hence one head of cattle requires in 365 days, about 10,950 pounds of dry clover, or about 100 cwts. of 110 pounds each; the portion of food being according to this mode of feeding alike both in ſummer and winter. Each head of heavy fat cattle fed in the ſtable, if plenty of food be given, yields annually 16 full double cart loads of dung. The rotation of crops that is moſt frequently uſed in Germany, upon farms occupied in ſtall-feeding, appears to be the following: "One year, manured for beans, peaſe, cabbages, potatoes, turnips, linſeed, &c.; 2. Rye; 3. Barley, mixed with clover; 4. Clover, to be mowed two or three times; 5. Clover, to be mowed once, then to be broken up, ploughed three or four times, and manured; 6. Wheat; 7. Oats."—In conſequence of the large quantity of ſtable dung produced upon farms thus occupied, every acre of land receives every three years 10 double cart loads of that beſt of all kinds of manure.

Advantages of the practice.

It is undoubtedly to be wiſhed, that a ſimilar mode of management could be profitably introduced into this country, from the tendency which it would have to augment the number of perſons occupied in rural affairs, from the importance which it would give to arable farms of a moderate extent, and from the benefit which muſt ariſe from making the moſt of every part of the ſoil. It has already been introduced into ſeveral places in England; and we have little doubt that the practice will gradually extend itſelf, in conſequence of the increaſing demand

demand for butchers meat, and for all the productions of the dairy.

Breeding and Feeding of Black Cattle.

Mr Young obſerves *, that "lucerne and tares ſhould never be conſumed in any other way, but every other crop will be uſed to proportionable advantage: cows alſo do very well when regularly fed in this manner; and it is ſo profitable that it can never be recommended too ſtrongly."

Opinions in favour of the practice.

In his travels he obſerved particularly † "the practice in Flanders, and in ſome degree in Quercy, &c. of keeping cows, oxen, and all ſorts of cattle, confined in ſtables the whole year through. This I take to be one of the moſt correct, and probably one of the moſt profitable methods that can be purſued; ſince, by means of it, there is a conſtant accumulation of dung throughout the year, and the food is made to go much farther."

In an Eſſay formerly quoted, the Rev. H. J. Cloſe remarks, that "the only objection to carting the green vegetables home to ſheds, both in winter and ſummer, is the additional labour and expence; but theſe are paid for in a tenfold degree by the increaſed value of the food, the thriving of the cattle, the making the dung under cover, and having reſervoirs to catch the urine. With this management one good acre of turnips will produce an excellent dreſſing for an acre and a half of land, and will completely winter-fat an ox of 50 ſcore. If fed on the land, two acres may fat an ox, but not ſo well, and the dreſſing will be very partial and precarious.

"Horſes,

* *Annals of Agriculture*, vol. xxxii.

† Vol. ii.

Breeding and Feeding of Black Cattle.

"Horſes, bullocks, cows, &c. of all ſorts, ſhould, in my opinion, be under ſheds winter and ſummer, except a few hours in the day time in winter, and a few hours in the evening or at night in ſummer. One acre of graſs, clover, lucern, or vetches, cut and carted to the ſheds, will ſupport three times as many cattle in better order than the ſame acre when fed in the common way. The waſte in this mode muſt be great from the trampling of the cattle; and, on paſture lands, they will naturally pick the moſt palatable graſſes firſt, and leave the others to run up to bents. No mixture of cattle can prevent this; for though one ſort may prefer one ſpecies of graſs, and another another, it is altogether impoſſible ſo to proportion each ſpecies of cattle to the ſpecies of graſs moſt palatable to it, as to prevent a ſcarcity of one ſort, and an abundance of the other. It muſt alſo be obſerved, that when there is a mixture of cattle, they frequently interrupt each other, and do not thrive. By ſtalling, all the green food is eaten, and no part of it waſted. The cattle fill themſelves in half the time, and have more hours for reſt. They cannot interrupt each other. The dung made under cover is not only much ſtronger, and in much larger quantities, but can be applied to any part of the farm, inſtead of being almoſt entirely loſt, as when dropped on the paſtures. The cattle are never liable to kick each other, or to be damaged by breaking paſture; and it will never be neceſſary for a ploughman to loſe a day's work, ſearching the adjoining fields or pariſhes for his horſes. Theſe experiments and arguments will, I truſt, appear concluſive, as to the beſt mode of applying green vegetable food both in ſummer and winter. For my horſes I have erected cheap thatched ſheds, in which they have room

to

to walk and roll, and in theſe they go winter and ſummer; to which I attribute it, that they are not ſo liable to cold as thoſe kept in a hot ſtable, and are never cracked or greaſy-healed. For my bullocks and cows my ſtalls are ſeven feet wide, each ſtall holding two head of cattle, each faſtened by the neck cloſe to the ſide of the ſtall to prevent their interfering with each other with their horns.

Breeding and Feeding of Black Cattle.

Upon the the ſame ſubject, the following letter from a gentleman in Leeds to Meſſrs. Rennie, Brown, and Shireff, together with their remarks upon it, is worthy of attention. "There are a few cows kept in the houſe all ſummer, and the way in which they are managed is by giving them graſs freſh cut, and watering the ground, as the graſs comes off with the urine from the cows. The urine is preſerved in a ciſtern placed on the outſide of the cow-houſe, and is conveyed to the land at almoſt all ſeaſons, but the moſt profitable time for doing it is March, April, and May; by which means and the addition of horſes dung applied during the winter months, the field may be cut four or five times during the ſeaſon. I am told four acres of land will, in this method, maintain ten cows; and in the winter they are fed with grains from the brewers, which are very high in price, being 3s. 6d. per quarter. It will take about four pounds worth of grains to maintain a cow for the winter months, and two pounds for graſs during the ſummer; ſo the expence of a cow for the whole year is about ſix pounds.

"I kept 13 cows one winter, which were fed upon turnips and oat-ſtraw, and never got a mouthful of hay. They yielded me 30 gallons of milk per day which, ſix years ago, ſold upon the ſpot to the retailers from Leeds,

at

Breeding and Feeding of Black Cattle.

at 5½d. per gallon. They carried it a mile, and ſold it out at 6½d. and 7d. per gallon; but it is now advanced to 8d. and 9d.

"I muſt notice to you, that the taſte of the turnip is eaſily taken off the milk and butter, by diſſolving a little nitre in ſpring water, which being kept in a bottle, and a ſmall tea-cup full put among eight gallons of milk, when warm from the cow, entirely removes any taſte or flavour of the turnip.

"In the management of cows, a warm ſtable is highly neceſſary; and the currying them, like horſes, not only affords them pleaſure, but makes them give their milk more freely. They ought always to be kept clean, laid dry, and have plenty of good ſweet water to drink. I have had cows giving me two gallons of milk at a meal, when within ten days of calving. The average of our cows is about ſix gallons per day after quitting the calf.

"In addition to the above very ſenſible letter, we may add, that one of us, for ſome years, has kept his cows in the houſe upon red-clover and rye-graſs during the ſummer months. They are put out to a ſmall park in the evening after milking for the convenience of getting water, and tied up in the houſe early in the morning. One acre of clover has been found to go as far in this way as two when paſtured. More milk is produced, and the quantity of rich dung made in this method is ſuppoſed to compenſate the additional trouble of cutting and bringing in the graſs."

Two modes of ſtall-feeding.

Of ſtall-feeding, however, whether with a view to the maintenance or to the fattening of cattle, it muſt be obſerved, that there are two modes of proceeding. Of late years it has been found advantageous to cultivate

vate to a great extent turnips, potatoes, and other roots, and theſe now conſtitute a large portion of the winter food of cattle. Theſe roots are either given to the cattle in their natural raw ſtate, or they are given after being boiled. Of theſe two modes of feeding, that of giving them to the cattle raw has hitherto been the moſt common, but it is extremely improper, as being a thriftleſs plan of proceeding. The ſame quantity of theſe roots, if given in a raw ſtate, that will barely ſupport a horſe in idleneſs, will enable him, when boiled, to encounter the ſevereſt labour without injury to his health or ſpirit. There are many animals alſo, ſuch as hogs, which cannot be fattened by roots unleſs they undergo this proceſs. Theſe animals can be reared to the full ſize upon raw potatoes, yams, carrots, roota baga, &c. and may be kept in good health for any length of time without the aid of any other food. Under that management, however, they very ſeldom if ever fatten; but when the roots are boiled, they immediately begin to feed, and ſoon become fat upon a ſmaller allowance than what was neceſſary to keep them barely alive when given in a raw ſtate.

Breeding and Feeding of Black Cattle.

The ſame holds true in a great degree with regard to all cattle. With a view, therefore, to make the moſt of the various ſucculent roots which are now cultivated, and which will perhaps one day be accounted the moſt valuable productions of our ſoil, it is abſolutely neceſſary that they ſhould be given to cattle boiled. Many huſbandmen have long been ſenſible of this, but it has appeared a very formidable operation to boil the greateſt part of the food of perhaps 20 horſes, and 100 head of black cattle. There is nothing more true, however, than that this labour, when undertaken upon

Roots given to cattle ſhould be boiled.

ſkilful

Breeding and Feeding of Black Cattle.

ſkilful principles, may be rendered not only eaſy, but ſo trifling, that it may be performed by a ſingle old man, or by a woman. To accompliſh the object, however, it is neceſſary, that the roots be boiled not over the fire in a caldron of metal, but at a diſtance from it, in a large wooden vat or tub, by the ſteam of boiling water.

Cheap mode of boiling roots by ſteam.

There are two ways of boiling roots by ſteam. They may either be boiled in ſuch a way as to retain their original figure, or they may be converted into ſoup; both modes are performed with equal eaſe. All that is neceſſary, is to erect a boiler in any outhouſe: The boiler, which may be of caſt iron, ought to have a cloſe cover or lid, having a ſmall hole for filling it with water, which can be eaſily cloſed up, and another hole in the centre of about one-fourth of the diameter of the cover. To this laſt hole ought to be ſoldered a tube of tin-plate, commonly called *white iron*, by which the ſteam may aſcend. This tube ought to riſe perpendicularly to the height of ſix feet, narrowing gradually to about two inches diameter. It may then bend off at right angles, to the moſt convenient ſituation for the tub or vat in which the roots are to be boiled. When it comes perpendicularly over the centre of the vat, it muſt be made to deſcend to within two or three inches of the bottom of it, being properly ſupported and fixed all the way.

To boil roots with this apparatus, it is only neceſſary to tumble them into the tub or vat into which the end of the white-iron tube deſcends. The tub ought then to be covered negligently. The water in the boiler being heated to ebullition, its ſteam or vapour riſes and paſſes along the white-iron tube, and at laſt deſcends

deſcends to the bottom of the wooden veſſel containing the roots, and in a very trifling period of time renders them completely ſoft. If it is wiſhed to convert theſe roots into ſoup, it is only neceſſary to throw among them a quantity of water, and to beat them down with any large ladle or other inſtrument. The ſteam continuing to deſcend will ſpeedily boil the water, and agitate and mingle the whole ingredients of which the ſoup may be compoſed. In this way, by various mixtures of roots, with little or no trouble, rich broths, which human beings would not diſlike, may be formed for feeding a multitude of cattle, and the ſoup may eaſily be drawn off from the bottom of the vat by means of a hole to be occaſionally opened or ſhut with a round piece of wood. Breeding and Feeding of Black Cattle.

In performing the above operation, however, of forming broth or ſoup, before allowing the water in the veſſel over the fire to give over boiling, the hole ought to be opened by which it is uſually filled with water, as the liquor in the vat might otherwiſe, in conſequence of the preſſure of the atmoſphere, aſcend through the white-iron tube and come over into the boiler. To ſtrengthen the white-iron tube, it may be proper alſo to cover it all over with paper paſted to it with glue, or with a mixture of peaſe-meal and water.

A ſtill more ſimple mode of boiling potatoes or other roots, by ſteam, is deſcribed in the Annals of Agriculture *, as uſed by Mr Crook of Tytherton in North Wiltſhire, who uſes potatoes thus dreſſed on a large ſcale for fattening oxen. "He takes a veſſel fitted to the ſize Another mode.

* Vol. xxxii.

Breeding and Feeding of Black Cattle.

of his boiler. One that is generally made uſe of for heating water for waſhing is ſufficiently large, holding about eight or ten gallons of water. In the bottom of this ſteamer there are a number of holes about the ſize of a common auger, which allow the ſteam to paſs through the potatoes with which the boiler is filled; the bottom, where it reſts on the mouth of the boiler, being made tight with a wet cloth, to ſecure the ſteam from eſcaping. The ſteamer, for eaſe in emptying and filling, does not hold more than from one to two buſhels. The potatoes are quickly dreſſed, and the water draining from theſe ſupplies the exhauſting of the ſteam; they are then overturned into a cooler, and more put in their place: the potatoes are afterwards mixed with chopped hay and ſtraw. The cattle are kept in houſes or ſheds, and furniſhed with this food without any addition of corn.

Rules for fattening cattle.

To fatten cattle with ſucceſs, then, we apprehend that the following rules ought to be adhered to. As a man is kept thin and meagre by whatever agitates his mind, or renders him anxious, fretful, and uncomfortable, ſo we ought to conſider that cattle, though they want foreſight of the future, have nevertheleſs minds capable of being irritated and diſturbed, which muſt ſo far waſte their bodies. In attempting to fatten them, therefore, care ought to be taken to preſerve the tranquillity of their minds, and, as much as poſſible, to keep them in a ſtate of cleanneſs and of moderate warmth. The food they receive ought to be varied at times to increaſe their appetite; but, above all things, it ought to be made as far as poſſible of eaſy digeſtion, that they may receive it in larger portions, and that a greater quantity of it may incorporate with their conſtitution,

ſtitution, and not be thrown off by dung, as happens when they receive coarſe nouriſhment. It is in vain to object to this artificial mode of proceeding, that the natural food of animals is graſs alone, and that their natural dwelling is the open air. The ſame might be ſaid with regard to the human ſpecies. In this natural, that is, in this unimproved ſtate, a ſavage may be under the neceſſity of eating raw fleſh or herbs, or of climbing into a tree for ſhelter; but although it may be poſſible for him to ſubſiſt in this way, yet we know that this is by no means the beſt mode of his exiſtence, and that his life and health are better preſerved by the ſhelter of a ſettled dwelling, and by more delicate food prepared by induſtry. In the ſame manner, it is no doubt true, that cattle can exiſt upon very coarſe food, and may be even fattened by means of it; but as a greater quantity of it becomes neceſſary, the huſbandman's profit in rearing them is ſo far diminiſhed, and the value of his lands to the community is leſſened.

Rearing and Fattening Hogs.

SECT. IV.

OF THE REARING AND FATTENING OF HOGS.

UNDER a proper mode of management, from their rapid multiplication and quick growth, theſe are a very profitable kind of ſtock; though they have not hitherto been reared in Scotland, or fed by farmers ſyſtematically, upon a great ſcale. To do this with advantage, every thing depends upon adopting a proper plan for providing them with ſubſiſtence. "Whoever deſigns, ſays

Rearing and Fattening Hogs.

Mr Young's rules for rearing hogs profitably.

Mr Young *, to enter largely into keeping hogs, muſt make a very ample proviſion of food for all the ſeaſons of the year, and for every ſort of ſtock: if he does this with a proper foreſight, he will find that no animal upon his farm will pay him better; but, on the contrary, none will anſwer worſe, if not ſupported in great plenty. The following are the articles of food, which he muſt particularly attend to.

"*Clover.*—Whoever would make the moſt profit of which his hogs are capable, muſt not think of doing it without the aſſiſtance of this plant. The great uſe of it in ſupporting ſwine was very little known till of late years. I have practiſed it many years with the greateſt ſucceſs. A ſmall clover field, very well fenced, with a pond in it, ſhould be ready to receive the hogs the beginning of May. When firſt drove, a man and boy ſhould keep with them late the firſt two or three evenings, to ſee that they do not attempt breaking out to come home, and to drive them to ſome warm hollow under ſhelter in a dry ditch, or under a ſmall moveable ſhed littered: they will take very readily to ſuch; and having been uſed to it a few nights, you need be under no further trouble about them till after harveſt, or till the acorn ſeaſon or the clover is done. All hogs that are paſt weaning, that is, a quarter, half, and full-grown; boars, and ſows that have no pigs with them; ſows whoſe pigs are in the ſty, and themſelves let out to bait: for all ſuch, it is as fine food as can be provided; and there is no other way of keeping them nearly ſo cheap.

* *Annals of Agriculture*, vol. xxxii.

cheap. An acre will feed from 12 to 20 middling-ſized hogs through the ſummer. Rearing and Fattening Hogs.

"*Lucern.*—The beſt culture of this graſs does not admit in common of its being fed; if uſed for ſwine, therefore, it muſt be ſown for ſoiling. This I have known practiſed with very good ſucceſs. For one month's food, however, in the ſpring before clover is ready to feed, lucern would be very profitable.

"*Tares.*—The ſame obſervation is applicable to winter and ſpring plants; they muſt both be given in ſmall racks, or elſe ſcattered over a ſmall graſs field adjoining to the hog-yards.

"*Potatoes.*—Of all articles of food which it is neceſſary to provide very amply, none is ſo indiſpenſably neceſſary as this root. The farmer ought every year to have ſeveral acres of the Howard or cluſtered ſort, as that yields by far the greateſt crop. They are of uſe in every ſtep of the hog's progreſs. Boiled, but better ſteamed, they will wean young pigs, and fatten the largeſt hogs; and raw, they are an excellent ſupport to all other ſtock; ſuch as ſows, ſhoots, and full-grown hogs. When a a farmer has found how many buſhels an acre of his land will yield, he may then proportion them upon this hint, that 300 buſhels will winter-feed, during ſix months, 15 ſhoots, having ſome other aſſiſtance, to begin when three or four months old; and the advantage by feeding them will, according to circumſtances, yield from 4d. to 6d. per buſhel; but, on an average, 5d. ſuppoſing the times reſpecting hogs to be good: and in fattening them the potatoes will pay alſo from 4d. to 6d.

"*Carrots*, though inferior to the preceding root for hogs, are of great uſe; they do excellently well for all

Breeding and Fattening Hogs.

ſorts of lean ſtock; and alſo for weaning pigs, with the aſſiſtance of a little dairy waſh. Several other perſons have fattened hogs on them boiled; but as they have often failed, and potatoes are certainly ſuperior, I ſay nothing of that application. Upon very poor ſandy ſoils, they ſhould be ſubſtituted inſtead of potatoes, much more than on better ſoils; for the cluſter potato will yield very large crops on ſuch. But carrots come to a conſiderable produce on the very pooreſt, and without dung; hence they are amazingly valuable, in ſuch countries, to thoſe who would go any length in keeping hogs.

"*Parſnips* are, I believe, to be preferred greatly to carrots. They fatten all their pork in the iſland of Jerſey with them. They are a much more ſaccharine root; and it is known, that nothing fattens a hog faſter, or makes finer pork, than the ſugar cane.

"*Cabbages.*—From September to the end of December there is no plant will keep the common ſtock ſo cheaply as this, while they are green and freſh; and before much of them grows putrid or turns yellow, they yield an immenſity of food, which will ſupport the ſows and ſhoots to their growth, but will not do to wean upon, without conſiderable aſſiſtance.

"*Turnips.*—The ſame is to be obſerved of turnips, but in an inferior degree; for cabbages are a much better food."

Of breeding hogs.

This author remarks, that there is an endleſs variety of breeds of ſwine in England; but he prefers the large Chineſe breed, which riſes to a conſiderable weight: he remarks, that the ſows ſhould always be kept confined in their yard, except when they are in the clover field; they ſhould not go to the boar till they are

nine

nine months old, and, if they are a year, it will be better. When great with pig, they muſt be in a yard by themſelves in winter, not to be diſturbed by the boars and ſhoots; and for about a fortnight before they pig, they ſhould be confined to the ſty, but each to have a ſmall area to it. While pigging, it is eſſential that nobody goes near them, not even to look at them; for ſome will eat their pigs, in that caſe, that would never touch them, if they were not diſturbed. They ſhould be fed moderately before pigging, but afterwards they muſt have as much as they will eat of dairy waſh, and baits of turnips, carrot, cabbages, or potatoes, for want of waſh, with boiled potatoes or carrots, and a little meal, once a day, for a fortnight. They muſt be kept well littered and clean; but at pigging, not with too much, as they are more apt to overlay their pigs in it for the firſt week. When they have pigged a week or ten days, they may be let out of the ſties into their yard for three or four hours in the middle of the day to ſtretch their legs, which is better than total confinement. Rearing and Fattening Hogs.

"Sows, when expected to take the boar, ſhould not be kept too fat. I have been told by an obſerving farmer, that when his ſows have gone to boar in a great acorn time, being in high order, they have never had many pigs; and that it was a common obſervation.

"The proper age at which to wean pigs is two months, having caſtrated them at ſix weeks. They muſt be kept in ſties that have a ſmall yard for them to run in, and both kept perfectly clean and well littered with wheat ſtraw or ſtubble. Their food muſt be good, and given as plentifully as they will eat. Boiled potatoes or carrots for a fortnight, and then raw ones, will prove

Rearing and Fattening Hogs.

a good food; with a bait every day, for a month, of oats, and afterwards pea or bean or buck-wheat meal, unleſs there is a dairy; and then a meſs of milk or whey will anſwer inſtead of it. This muſt be the management till the clover field is ready for them, which may be the beginning of May; and if the pigs are three months old, they will do well on that food. During the weaning the article of plenty of clean ſtraw and great cleanneſs, ſo as the pigs may always have fine ſmooth ſleek coats, is of ſuch conſequence, that the greateſt plenty of food will not make amends for the want of it.

"The young hogs that are weaned, and arrived at the age of three or four months, muſt, through the year (except when in clover) be confined to a yard by themſelves. Their food may be turnips or cabbages, potatoes or carrots; alſo malt grains, if they ſell, as they do in many places, at 3d. a buſhel. Turnips alone will not do; they ſhould with them have an allowance of corn: cabbages are much better; but carrots and potatoes will keep them without any help to their full growth. If it is ſummer, nothing is better than the clover field.

"For older hogs, of courſe, the ſame regimen will, for ordinary food, be ſufficient.

Fattening.

"To fatten any kind of ſwine, uſe may be made of potatoes; but for this purpoſe they muſt be boiled or ſteamed, and a ſmall quantity of any kind of meal may be added with advantage. "When hogs are fattened on corn, ſays Mr Young, I am clear in the advantage of grinding it to meal; in which ſtate, given dry, I have fattened many hogs very expeditiouſly; but they muſt have water always by them, as they ſeem to fatten in proportion

proportion to their drought. But, if corn is beſtowed, by much the beſt way of uſing it is to put the meal into ciſterns or tubs, and add water enough to make it of the conſiſtence of cream; to keep it ſtirring every day till it has fermented and become ſour, which, in weather not very cold, will be in three weeks; and then to give it to the hogs, keeping meſſes prepared beforehand to ſucceed each other. I have tried this method many years, and with uniform ſucceſs; and have found, by weighing the hogs alive every week, and making compariſons with the food, that none come up to it, being the moſt profitable of all others. Uſe half barley and half peaſe-meal, to chooſe; but if not, all of either; beans do not make ſo good pork. I do not perceive that the hogs are ever drunk with it, which they of courſe would be, if the vinous fermentation took place. The drunkenneſs of the diſtillers hogs is ſaid to be the reaſon of their fattening." Rearing and Fattening Hogs.

This laſt circumſtance has induced ſome perſons to mix ſmall quantities of poppy ſeed with their food, or even opium itſelf; and the practice, when managed with delicacy, is ſaid to have proved advantageous.

"With regard to the profit to be made by entering largely into this branch of huſbandry, it will depend, as in moſt other caſes, on a variety of circumſtances; I mean the *degree* of the profit; for in every ſituation with which I am acquainted, the advantage is not inconſiderable. It will depend on the price of lean hogs, and on that of fat pork; and alſo on the crops, and the cheapneſs with which cabbages, carrots, potatoes, and clover, can be raiſed. To give any particular calculations would not, therefore, be eaſy: in general, however, I ſhall obſerve, that there is no ſort of ſtock Profit.

kept

Rearing and Fattening Hogs.

kept upon a farm that will pay better than hogs; but this depends on very ample proviſion being made for them, as I know no ſtock that will leſs bear a deficiency of food."

A ſow will produce three litters in fourteen or fifteen months, ſo that the produce within a year is very great. "In general the advantages to be reaped from this ſtock are more applicable to all ſorts and ſizes of farms, to very ſmall, as well as to extremely large ones, and to every place and ſituation. But it is very rare that I have ſeen the benefit made of them, which they will admit of; reſulting from the unwillingneſs, ſo general among farmers, to raiſe crops on purpoſe for them: they can keep a few without any expence whatever, and therefore they will not raiſe food for many. It is very eaſy for a young farmer to try the experiment on two or three ſows, and the pigs bred by them; or by buying in ten or a dozen ſhoots at Michaelmas: the clover will probably be on his farm, and a very few cabbages, potatoes, or carrots, would do the reſt."

Deſcription of a proper hog-ſty.

Hog-ſties are of ſimple conſtruction; they require only a warm dry place for the ſwine to lie in, with a ſmall area before, and troughs to hold their food. They are generally made with ſhed-roofs, and ſeldom above ſix or ſeven feet wide.

Although ſwine are generally conſidered as the filthieſt of all animals, yet there is no animal delights more in a clean comfortable place to lie down in, and none that cleanlineſs has a better effect upon with reſpect to their thriving and feeding. In order to keep them dry, a ſufficient ſlope muſt be given, not only to the inſide where they lie, but to the outſide area, with proper

proper drains to carry off all moiſture. The inſide ſhould alſo be a little elevated, and have a ſtep up from the area at leaſt five or ſix inches. Hog-ſties ſhould have ſeveral diviſions to keep the different ſorts of ſwine ſeparate, nor ſhould a great many ever be allowed to go together; for it is thought they feed better in ſmall numbers, and of equal ſize, than when many are put together of different ſizes. Proper diviſions muſt, therefore, be made, ſome for ſwine when with the boar, others for brood ſwine, and for them to farrow in, for weaning the pigs, for feeding, &c. Rearing and Fattening Hogs.

Swine are apt to ſpill and waſte a great deal of their meat by getting their feet among it, unleſs proper precautions are taken to prevent them. This may be done by making a rail or covering of thin deal ſlope from the back part of the trough towards the fore part, leaving juſt room enough to admit their heads. There ſhould alſo be diviſions acroſs the troughs, according to the number of ſwine, to prevent the ſtrongeſt driving away the weakeſt. Theſe diviſions need not extend to the bottom of the troughs, but ſhould riſe a little higher than the top, and may be made of pieces of board about eight or ten inches board.

Sties ought to be ſo conſtructed that the ſwine may be eaſily fed without going in among them. In ſome places it is ſo contrived that they may be fed through openings in the back kitchen wall, without ever going out of doors. This is very convenient where only a few ſwine are kept for family uſe, and makes it eaſy to give them the refuſe of vegetables and other things from the kitchen, which, perhaps, would otherwiſe be thrown away. Where pigs are to be reared on an extenſive ſcale, there ought to be what is called in England

Rearing and Fattening Hogs.

land a *pigs kitchen*, that is, a proper apparatus ought to be erected adjoining to the hog-ſty, for boiling their food by ſteam.

Example of hogs fed with clover and potatoes, &c.

In a letter to the Earl of Hardwicke, which was communicated to Mr Young, the Right Honourable Theophilus Jones, an Iriſh gentleman near Dublin, gives the following account of his mode of feeding hogs among clover and potatoes, which will probably ſupply ſome uſeful hints to a judicious farmer *.—"I have for ten years, (ſays this gentleman), kept from twenty-five to thirty ſwine for the uſe of my houſe, (eight of which, when ſufficiently fat for bacon, weigh more than two hundred weight), by penning them upon clover, from the latter end of April to the latter end of October, in a ſpace of about twenty yards ſquare, hurdled or railed off. The fence is changed every day, and the hogs are driven to the ſpot at five o'clock in the morning, and brought back to their ſty at ſix in the evening, where they are fed with the broth and butter-milk from the kitchen and dairy. In this manner, without any other food, they are kept in good condition, as ſtore hogs, till the month of November, when it is neceſſary to feed them for uſe. A plantation acre and a quarter (which is equal to two Engliſh acres) of tolerably well grown clover, is ſufficient to feed them during the ſeaſon, as they go over the ſame ground, according as the ſeaſon anſwers, and as the clover grows again, three or four times, leaving the ſpace they feed upon each day as bare as a fallow; ſo that by the time they have gone over the land three times in this manner, it will be highly

* *Annals of Agriculture*, vol. xxxiv.

ly manured for potatoes againſt the next ſpring, and will produce much more food than will be neceſſary to keep the ſame number of hogs for the remainder of the year, and to fatten ſuch as are neceſſary for the uſe of the houſe. Rearing and Fattening Hogs.

The bacon hogs are fed by themſelves, and there is a place raiſed about a foot from the ground ſufficient for them to ſleep upon, railed cloſe at the bottom, to prevent their ſtraw from being dirty or wet. The troughs for their food are upon the ground, and they are fed four or five times in the day, with potatoes boiled in ſteam and the waſh milk from the dairy: In two or three months at moſt they are fit for uſe. The ſows and hogs intended for pork are kept in the common ſty, and fed upon the ſmall potatoes well-waſhed, but not boiled for them. The ſmall Chineſe hogs anſwer beſt for pork, and are bred at home. As they are wanted for the table, they are put into ſeparate cells, and fed with boiled potatoes and milk or broth, in the ſame manner as the bacon hogs, and in two months are fit for the table.

"Never having been diſappointed in the courſe of my experience by feeding ſwine in this manner, I conceive it might be advantageous to farmers to extend the practice much farther than I have done, and that it may be of uſe to them (if they can be induced to make the experiment) to know how I have managed the land that has been applied to that purpoſe. The ground that the hogs have fed upon is ploughed as ſoon as may be convenient after they are taken off, and well-worked three times before the middle of March, by which time it is ſufficiently tilled for potatoes. I plant the potatoes in drills twenty-eight inches diſtant.

Rearing and Fattening Hogs.

diſtant. A plantation acre will produce from thirty to thirty-ſix tons. By having the ſtalks, when the potatoes are ripe, pulled and taken clean off the land, a plough, with a ſtrong draught of horſes or oxen, will take out an acre of potatoes in a day, much cleaner and better than they can be done by the ſpade, as the plough does not cut them. The plough muſt be let deep into the ground, and go up and return again upon each drill. There muſt alſo be ſufficient pickers to gather the potatoes, or the work will be retarded. I then harrow the ground acroſs, and when convenient plough it thoroughly, and gather the potatoes that may have been left after the firſt ploughing, which will perfectly clean the land, and amply pay the expence of the labour, and leave the ground in excellent order for ſowing barley, with red clover, in the ſpring.

" In folding the hogs, obſerve not to leave any furrows, that the pens may be ſo cloſe to the ground, that the ſmall ſwine may not be able to run under them.

" By this courſe of tillage a ſucceſſion of profitable crops may be produced for three years, and the land (without any other aſſiſtance) ſufficiently manured both for the potatoes and barley.

" At firſt I tried leaving the ſwine out day and night, which did not anſwer; and I have, upon very ſevere rain, found it better not to turn them out upon the clover, but to give them cabbage-leaves and lettuces from the garden: but this ſeldom is neceſſary."

SECT.

Sheep.

SECT. V.

SHEEP.

Experiments on feeding sheep with roots.

THE rearing of ſheep properly belongs to the article paſturage. So far, however, as they are fed upon the products of human induſtry, they belong to the preſent ſubject. In the Memoirs of the Royal Society of Agriculture in Paris for the year 1788, the reſult is given of certain experiments upon the advantage and economy of feeding ſheep in the houſe with roots. The experiments were made by M. Crette de Palluel. He ſtates that the cuſtom of feeding ſheep in a houſe is common in ſeveral of the French provinces, but in others is unknown: That the mode of fattening them in that ſituation conſiſted of giving them clean corn and choice hay: That in ſubſtituting roots for corn, hay was continued to be given to them, either of clover, lucern, after-math, or any other ſort. The corn commonly uſed for fattening ſheep is barley and oats; ſometimes gray peaſe, or the marſhed beans, and rye. "Although the ſheep fed upon roots (ſays M. Crette) did not acquire quite ſo great a degree of fatneſs as thoſe fed upon corn; it is however true, that they all fattened, and that if their food had been varied, they would have made greater progreſs: I can even aſſert the fact of four, which were put upon change of food towards the end of the experiment, and ate much more.

"The

Sheep. "The ſheep put to potatoes ate little at firſt, for ſome days, which prevented them from thriving ſo much as the others; but they recovered the ſecond month what they loſt the firſt. As for thoſe put to turnips and beets, they fed heartily from the firſt moment, and continued it. They all drank much leſs than thoſe fed upon corn.

"Corn might with advantage be added to the roots: When the ſheep are intended to be ſold, two feeds of corn given them for a fortnight, in the intervals of their meals of roots, would harden both their fleſh and their tallow.

"It was not ſufficient to prove the poſſibility of fattening ſheep with different kinds of roots; it was farther neceſſary to aſcertain the qualities which their fleſh might acquire, by the uſe of them. Four ſheep, fed upon the four regimens, were killed the ſame day; there was indeed ſome trifling difference in the texture of their fleſh, but upon the whole the flavour of all was the ſame. Let us then conclude, that the culture of roots opens to us infinite reſources, not only for fattening of ſheep, but alſo of beaſts; and we do not doubt of their being uſed to the greateſt advantage in bringing up cattle in the countries where they are bred.

"The knowledge of theſe experiments muſt induce farmers to adopt this culture, ſince it is ſo advantageous. Roots cannot be exported; corn, on the contrary, is exported; and the grower may ſell the roots inſtead of conſuming them. One acre of roots is equal to five acres of corn. By this means he multiplies his land, and may conſequently multiply his cattle and

his

his dung-hill: added to this, roots are not ſubject, like corn, to the inclemencies of the ſeaſons; the produce is always more certain; theſe plants being of different natures, it is not likely that they ſhould all fail; the earth is a more faithful depoſitory of our treaſures than the atmoſphere; the dreadful hurricane of the 15th of this month (July) deſtroyed every thing but roots; they are the only product which eſcaped its ravages; if the hail tear their leaves, others will ſoon ſhoot; and carrots, beets, turnips, and potatoes, will be ſafe."

The reſult of the experiments alluded to is given in the following terms:

Experiment upon Fattening Sheep, and their Increase from Month to Month.

Sixteen sheep, of the same age, of four different breeds, were picked out of my flock, viz. four the breed of the country, four of Beauce, four of Champagne, and four of Picardy; I weighed them alive, and marked each with a number; I divided them into four lots, and fed them on four different sorts of food, as under.

Food.	N°	Breeds.	Weights at different Periods.—1788.					Increase each Month.				Total incr. which each food has produced upon four Sheep.
			Jan. 20.	Feb. 20.	Mar. 20.	April 20.	May 20.	1st M.	2d M.	3d M.	4th M.	
Potatoes,	1	Isle de France,	69¼lb.	79¾lb.	—	—	—	10lb.	lb.	lb.	lb.	70 lb.
	2	Beauce,	70¾	82½	90¼lb.	93lb.	95lb.	11¼	7¼	2¾	2	
	3	Champagne,	69¼	83	82½	84	—	13¼	loss ½	1½	—	
	4	Picardy,	88	95	101	—	—	15	6	—	—	
								50½	13½	4¼	2	
Turnips,	5	Isle de France,	69	86	87	—	—	17	1	—	—	67½
	6	Beauce,	71	86	—	—	—	15	—	—	—	
	7	Champagne,	68½	78½	82½	84	84½	10	4	1½	½	
	8	Picardy,	79	95½	97½	97½	—	16½	2	—	—	
								58½	7	1½	½	

Beets,	9	Isle de France,	72	83 1/4	90 1/2	94	—	11 3/4	7 1/4	3 1/2	—	71
	10	Beauce,	70 3/4	80 1/4	86	—	—	10	5 1/4	—	—	
	11	Champagne,	77 1/4	90 1/2	—	—	—	13 1/4	—	—	—	
	12	Picardy,	80	93 1/2	98 1/2	100 1/2	101	13 1/2	5	1 1/2	1/2	
								48	17 1/2	5	1/2	
Oats, barley, and gray peas.	13	Isle de France,	74	91	95 1/2	102	106	17	4 1/2	6 1/2	4	92 1/2
	15	Beauce,	73 1/2	84 1/4	91 1/2	96	—	10 1/4	7 1/4	4 1/2	—	
	16	Champagne,	71	86 1/4	93	—	—	15 1/4	6 1/4	—	—	
	14	Picardy,	71	87	—	—	—	16	—	—	—	
								59	18 1/2	11	4	

Observation. The increaſe of theſe ſheep, during the firſt month, being ſo much more conſiderable than in the following months, muſt be attributed to this cauſe, that lean cattle put up to fatten eat greedily until they are cloyed, which only fills them, without much increaſing their fleſh; but, on the contrary, the increaſe produced in the enſuing months, although apparently leſs, turns all to profit in fleſh and tallow."

SEC

Rabbits.

SECT. VI.

RABBITS.

In particular ſituations theſe animals may be kept to advantage, as they multiply exceedingly, and require no trouble in bringing up. A conſiderable number of them are kept in Norfolk, where much land, conſiſting of barren hills or heaths, is proper for their reception. They delight in the ſides of ſandy hills, which are generally unproductive when tilled; but level ground is improper for them. Mr Marſhal is of opinion, that there are few ſandy or other looſe-ſoiled hills which would not pay better in rabbit warens than any thing elſe. "The hide of a bullock (ſays he) is not worth more than $\frac{1}{20}$th of his carcaſe; the ſkin of a ſheep may, in full wool, be worth from a ſixth to a tenth of its carcaſe; but the fur of a rabbit is worth twice the whole value of the carcaſe; therefore, ſuppoſing a rabbit to conſume a quantity of food in proportion to its carcaſe, it is, on the principle offered, a ſpecies of ſtock nearly three times as valuable as either cattle or ſheep. Rabbit warrens ought to be encloſed with a ſtone or ſod wall; and, at their firſt ſtocking, it will be neceſſary to form burrows to them until they have time to make them to themſelves. Boring the ground horizontally with a large auger is perhaps the beſt method that can be practiſed. Eagles, kites, and other birds of prey, as well as cats, weaſels, and pole-cats, are great enemies of rabbits. The Norfolk warreners

Rabbits more valuable than black cattle or ſheep.

warrens catch the birds of prey by traps placed on the tops of ſtumps of trees, or artificial hillocks of a conical form, on which they naturally alight.—Traps alſo ſeem to be the only method of getting rid of the other enemies; though thus the rabbits themſelves are in danger of being caught. Rabbits. Method of deſtroying birds of prey.

Rabbits may be fed during the ſummer with clover and other green food, and during the winter with cabbages. Where they are kept in an encloſure as part of the ſtock of the farm, a practice which has not yet been uſed in this country, they ought to be fed with great regularity, and with as much as they are willing to take. When this is done, they thrive upon a very moderate quantity of food; but if they are once allowed to ſuffer hunger in any great degree, they become extremely ravenous, and for a long time can ſcarcely be ſatisfied with food. In a communication to the Board of Agriculture from M. Bertrand of Mechlin, in the Netherlands, we are informed that the rabbits of the Angora breed yield in Normandy an uncommonly valuable wool, which ſerves as a primary material in ſeveral conſiderable manufactures. The Normans aſſert, that each rabbit yields wool of the value of a crown or ſix livres. Angora breed of rabbits.

SECT. VII.

POULTRY.

In many places on the continent poultry are reared as a part of the ſtock of a farm, and a portion of the

Poultry. land is cultivated for the purpoſe of raiſing food for them. We are alſo informed, that this has been done in a few inſtances in England. In particular it is mentioned in the Annals of Agriculture *, that one Shalcroft, who had a farm of 400 acres, and who lately died worth ten thouſand pounds, ſupplied the market of Croydon near London with fowls. In general, however, in that country, and univerſally in Scotland, fowls are kept merely as a kind of ſave-all, meant to be fed upon ſuch trifling articles of food as might otherwiſe go to waſte: Nor are we in poſſeſſion of any facts, in conſequence of which we could adviſe poultry to be kept as farm ſtock. It is certain, at leaſt, that where numbers of them are kept upon a corn farm, they ought not to be allowed to go at large; for not only will many of their eggs be loſt, and many of themſelves, perhaps, deſtroyed by vermin, but at certain ſeaſons they do a great deal of miſchief both in the barn-yard and in the field. No doubt, they pick up ſome grain at the barn doors that might otherwiſe be loſt; but if the ſtraw is properly thraſhed and ſhaken, there would be very little of this. In the common careleſs way of thraſhing, a great deal of corn is undoubtedly thrown out among the ſtraw; but when we conſider the dung of the fowls and their feathers that get among it, and the injury theſe muſt do to the cattle, this is no object. It is much better to allow the poultry a certain quantity of food, and to let the cattle have the benefit of what corn may remain among the ſtraw.

If poultry, therefore, are to be kept at all, they ought always

* Vol. xxvii.

always to be confined, but not in a close, dark, diminutive hovel, as is often the case; they should have a spacious airy place properly constructed for them. Some people are of opinion, that each sort of poultry should be kept by itself. This however, is not absolutely necessary; for all sorts may be kept promiscuously together, provided they have a place sufficiently large to accommodate them conveniently, and proper divisions and nests for each kind to retire to separately, which they will naturally do of themselves. Poultry.

This method is practised, with great success, at Mr Wakefield's, near Liverpool *, "who keeps a large stock of turkeys, geese, hens, and ducks, all in the same place; and, although young turkeys are, in general, considered so difficult to bring up, he rears great numbers of them in this manner every season, with little or no trouble whatever. He has about three quarters or near a whole acre enclosed with a fence only six or seven feet high, formed of slabs set on end, or any thinnings of fir or other trees split and put close together. They are fastened by a nail near the top, and another near the bottom, and are pointed sharp, which, I suppose, prevents the poultry flying over, for they never attempt it, although so low. Within this fence are places done up slightly (but well secured from wet) for each sort of poultry; also a pond or stream of water running through it. These poultry are fed almost entirely with potatoes boiled in steam, and thrive astonishingly well. The quantity of dung that is made in this poultry-place is also an object worth attention; Example of a proper mode of keeping poultry.

* Communications to the Board of Agriculture, by Robert Beatson Esq.

Poultry. and when it is cleared out, a thin paring of the furface is at the ſame time taken off, which makes a valuable compoſt."

It is generally underſtood that a full-grown hen continues in her prime for three years; and that during that period, if properly fed, ſhe will lay at a medium 200 eggs every year. The number, however, of eggs may be greatly increaſed by making the place to which this kind of poultry retire at night very warm and comfortable, by its being placed contiguous to a wall, on the other ſide of which a fire is kept, or by its being heated in any other manner. In the cottages of the poor in Scotland, where the poultry and the inhabitants ſleep under the ſame roof, the hens continue with a moderate portion of food to produce eggs during the greateſt part of the winter.

Profits doubtful.

Upon the whole, however, we have great doubts of the propriety of attempting in this country to rear poultry upon a farm on a large ſcale for profit. What are with us called *barn-door fowls*, are originally the natives of the hot climates of India, where at preſent they receive the appellation of *jungle fowls*, from frequenting in their wild ſtate woody thickets, which are there called *jungles*. With us they muſt be ſupported againſt the rigour of a foreign climate by large quantities of food, which has a tendency greatly to diminiſh the profit of rearing them. It is certain, at leaſt, that they cannot be profitably fed upon grain. Were it once eſtabliſhed, however, that they could be reared and fattened by boiled roots alone, ſuch as potatoes, carrots, and parſnips, or by mixtures of theſe with cabbages alſo boiled, they might then be found no leſs profitable than many other kinds of ſtock, providing always they were kept in a

confined

confined ſtate. The example of Mr Wakefield's practice, already ſtated, ſeems to give to ſuch a plan a proſpect of ſucceſs. It might be worth while, providing the poultry encloſure was ſituated upon a ſandy ſoil, to endeavour to augment the profit by feeding along with them a conſiderable number of rabbits, which are now become in this country a faſhionable article of food, and conſequently bring a conſiderable price in the market, while at the ſame time their wool muſt at all times be of great importance, and obtain a ready ſale. Poultry.

In Norfolk a great number of turkeys are bred, of a ſize and quality ſuperior to thoſe in other parts. Mr Marſhal accounts for their number in the following manner: "It is underſtood, in general, that to rear turkeys with ſucceſs, it is neceſſary that a male bird ſhould be kept upon the ſpot to impregnate the eggs ſingly; but the good houſewives of this country know, that a daily intercourſe is unneceſſary; and that if the hen be ſent to a neighbouring cock previous to the ſeaſon of excluſion, one act of impregnation is ſufficient for one brood. Thus relieved from the expence and diſagreeableneſs of keeping a male bird, moſt little farmers, and many cottagers, rear turkeys. This accounts for their number; and the ſpecies and the food they are fatted with (which, I believe, is wholly buck) account for their ſuperior ſize and quality." Great number of turkeys reared in Norfolk.

The following account of the Lincolnſhire management of geeſe is given by Mr John Foot of Brandon, in the Annals of Agriculture, vol. xiv. "It is generally allowed, that three geeſe to one gander is ſufficient; more geeſe would be too many, ſo as to render the eggs abortive. The quantity of eggs to very gooſe for ſitting above 12 or 13. They muſt be fed with corn Lincolnſhire management of geeſe.

in

Poultry. in their water whilſt ſitting, near them, ſo as to feed at pleaſure. The ganders ſhould be allowed to keep near them, ſo that they can ſee them, as they will naturally watch as a guard over their own geeſe.

" Their neſts ſhould be made for them of ſtraw, and confined ſo as the eggs cannot roll out when the geeſe turn them, which they do every day.

" When near hatching, the ſhell ſhould be broke a little againſt the beak or bill of the goſling, to give air, or to enable it to receive ſtrength to throw off the ſhell at a proper time. The method of plucking them about the beginning of April is this: Pluck gently and carefully the fine feathers off their breaſt and back; but be careful not to pull or interrupt their down nor pen feathers.

" You alſo pull their quills, five out of a wing; but I think four would be better. The quills will bear pulling in 13 or 14 weeks again, twice in a year; the feathers three times a year, of the old geeſe and ganders, ſeven weeks from the firſt pulling; and then again ſeven weeks after, which is the laſt pulling of the year.

" The young geeſe may be pulled once at 13 or 14 weeks old, but not quilled, being hatched in March.

" If the geeſe are late in hatching, I expect the brood geeſe ſhould not be plucked ſo ſoon as April, but the month after.

" If they are fed with barley and oats, as they ought to be, they will thrive and do the better, and their feathers will grow the faſter, and be better in quality; they muſt have plenty of graſs and water.

" Although perſons not acquainted with the management of geeſe, as above deſcribed, may think it inhu-

man;

man; yet I am credibly informed, they will do better than where they do not pluck them, if they are properly done, as they loſe their feathers by moulting, and would not be ſo healthy. Management of the Dairy.

"It is proved, that by annually plucking geeſe, as in Lincolnſhire, there is ſaved, by the increaſe of feathers, many hundred pounds value which other countries waſte, through a miſtaken opinion, as not an object worth their attention. Gooſe feathers are now ſold at 18s. a ſtone, that uſed about 25 years ago to be bought at 10s. or 11s. in that county.

"A gooſe will produce by this method about 1s. 6d. annually of good feathers and quills."

SECT. VII.

OF THE MANAGEMENT OF THE DAIRY.

Importance of the dairy.

In all but the richeſt corn countries, this is a moſt important branch of the buſineſs of a huſbandman. It includes not only the proper method of preſerving milk in a wholeſome and uncorrupted ſtate, but alſo the manufacturing from it the two valuable articles of butter and cheeſe.

Principles on which a dairy ought to be managed.

Dr James Anderſon remarks, that when a dairy is eſtabliſhed, the undertaker may ſometimes think it his intereſt to obtain the greateſt poſſible quantity of produce; ſometimes it may be more beneficial for him to have it of the fineſt quality; and at other times it may be neceſſary to have both theſe objects in view, the one or the other in a greater or leſs proportion: it is there-

fore

Manage-ment of the Dairy.

ſore of importance that he ſhould know how he may accompliſh the one or the other of theſe purpoſes in the eaſieſt and moſt direct manner.

To be able to convert his milk to the higheſt poſſible profit in every caſe, he ought to be fully acquainted with every circumſtance reſpecting the manufacture both of butter and of cheeſe; as it may in ſome caſes happen, that a certain portion of the milk may be more advantageouſly converted into butter than into cheeſe, while another portion of it would return more profit if made into cheeſe.

The firſt thing to be adverted to, in an undertaking of this nature, is to chooſe cows of a proper ſort. Among this claſs of animals, it is found by experience, that ſome kinds give milk of a much thicker conſiſtence and richer quality than others; nor is this richneſs of quality neceſſarily connected with the ſmallneſs of the quantity yielded by cows of nearly an equal ſize; it therefore behoves the owner of a dairy to be peculiarly attentive to this circumſtance. In judging of the value of a cow, it ought rather to be the quantity and the quality of the cream produced from the milk of the cow, in a given time, than the quantity of the milk itſelf: this is a circumſtance undoubtedly of more importance than is generally imagined. The ſmall cows of the Alderney breed afford the richeſt milk hitherto known; but individual cows in every country may be found, by a careful ſelection, that afford much thicker milk than others; theſe therefore ought to be ſearched for with care, and their breed reared with attention, as being peculiarly valuable.

Few perſons, who have had any experience at all in the dairy, can be ignorant, however, that in comparing

th

the milk of two cows, to judge of their reſpective qualities, particular attention muſt be paid to the time that has elapſed ſince their calving; for the milk of the ſame cow is always thinner ſoon after calving than it is afterwards; as it gradually becomes thicker, though generally leſs in quantity, in proportion to the time ſince the cow has calved. The colour of the milk, ſoon after calving, is richer than it is afterwards; but this, eſpecially for the firſt two weeks, is a faulty colour, that ought not to be coveted. Management of the Dairy.

To enable cows to give abundance of milk and of good quality, they muſt at all times have plenty of food. Mr Young remarks, that there are ſome farms peculiarly proper for cows, not more ſo than others on better ſoil, but upon which no ſtock will pay ſo well. Theſe are particularly ſuch as contain much rough wild paſture, too wet for ſheep. Rough waſte lands, quite dry, pay beſt under the latter animal; but when the ſoil is wet, they do better for cows. Farms containing much of this land ſuit the dairy or young cattle. Excluſive of ſuch general inſtances, that concern whole farms, Mr Young obſerves, that the chief articles of food for a dairy of cows, beginning with ſummer, are,

"1. *Graſs.*—Common meadows and paſtures, not exceedingly fine, are profitably applied to this uſe; but it is yet a queſtion whether cows will pay for very fine paſture that will fat a large ox. The very general application of ſuch to fattening, uſually called *grazing*, gives one reaſon to believe the dairy inferior on ſuch land; my own opinion unites in this with the general practice. They reckon in Cheſhire, that the worſt land makes the beſt cheeſe. Summer food of cows.

"2. *Clover.*—There are many arable farms where conſiderable

Management of the Dairy.

considerable dairies are kept very much by means of this graſs. It is not ſo good food as common meadows and paſtures that abound with various other plants; and is apt to make cheeſe heave, and be full of little holes, and if not carefully made, ill taſted. Without care alſo, the cows burſt upon being firſt turned in; yet, with all theſe objections, many hundreds of cows are almoſt entirely kept on it.

"3. *Sainfoin.*—Much ſuperior to the foregoing. It is ſweeter and better food, and will enable farmers on poor, dry, barren, chalky hills, to keep great dairies, where a ſingle cow would ſtarve without it.

"4. *Lucern.*—This graſs for all ſorts of cattle is the beſt of all the artificial ones; it yields a great quantity of the richeſt and ſweeteſt milk, and may be depended on from May to October with little or no variation from the ſeaſon. In the moſt dry and burning ſummers the growth will be nearly as great as in wet ſeaſons. A cow, not of the largeſt ſize, will eat from 90lb. to 110lb. of green lucern in 24 hours. Mr Baker found in Ireland that an Iriſh acre of this graſs would feed ſix cows 145 days.

"5. *Burnet* is very much liked by cows, and yields as ſweet butter as any other plant.

"6. *Tares* mown for ſoiling will do for them.

Winter food of cows.

"Concerning the winter food of cattle, Mr Young remarks, that one diſadvantage of having cows of a very fine breed is, that the farmer feeds them in a manner which the produce of a dairy will rarely pay for: for inſtance, keeping them on hay. Thoſe who are inclined to keep great numbers of cows, ſhould conſider well in what manner they are to pay for their food; with a very ſlight miſmanagement you may be greatly out of pocket.

pocket. It is very common to hear it aſſerted, that, to make money by cattle, they muſt be well fed: if it will not anſwer to feed cattle plentifully, it will not to feed them badly; and many ſuch wiſe obſervations, which mean little and teach leſs. They are very true, with given articles of food, and very falſe with others. From the firſt of November, when we may ſuppoſe a cow put to hay till May 12th, when the green fields will be ready to receive her, there are 193 days: a middling cow will eat 30lb. of hay a day without any waſte; or in that time more than two tons and a half;—"but ridiculous as it would be, adds this author, to feed a cow with hay through the winter, yet ſome of that food ſhould be given her. After calving ſhe ought to have it moderately; but if more than half a ton per cow is allowed, the farmer will not gain much by his dairy; and if you can reduce it lower by green winter food, ſuch as cabbages, turnips, or other roots, ſo much the better. While dry, till a month before they calve, they are to be in the ſtraw yard that has a pond's mouth in it; and there let them have the ſtraw given in cribs, in the order of its goodneſs, keeping the beſt till laſt, taking care to give all freſh thraſhed. 1. Wheat and rye. 2. Barley, without clover amongſt it. 3. Oats, ditto. 4. Peaſe and beans. Laſtly, Barley and oats, that has much clover in it. If the cows are valuable, or the ſtraw bad, they may have every day a bait of cabbages, turnips, &c. in bins. A month before calving they ſhould have each 10 or 15 pounds of hay every evening, or a better allowance of green food. After they have calved, they ſhould be well fed with green food, and for a fortnight with hay alſo; and the day ſhe calves, keep her confined, and give her warm water.

Management of the Dairy.

Management of the Dairy.

ter. Hence if the dairy is large, you cannot do without a diviſion in the yard or ſtalls, in which the food may be varied at pleaſure. Remember, in general, that cattle in high caſe will do on worſe ſtraw than poor ones; and that Liſle's maxim has a great deal of truth in it, viz. that cattle well ſummered are half wintered." Mr Young conſiders cabbages as the moſt profitable green food that can be given to cows: For a middle-ſized cow 70 or 80lb. a day of cabbages, with ſome ſtraw, is ſufficient. Many dairies are alſo fed largely and profitably upon turnips, of which, however, a cow will eat a larger weight than of cabbages. Carrots and potatoes he accounts the beſt winter food for cows, but he thinks them too coſtly. Malt grains are uſed in all great cities; they give much thin milk, that anſwers well in thoſe ſituations where it is ſold by meaſure."

Cows, how to be milked.

Cows, if abundantly fed, ſhould by milked three times a day during the whole of the ſummer ſeaſon; in the morning early, at noon, and in the evening juſt before night-fall. In the choice of perſons for milking the cows, great caution ſhould be employed; for if that operation be not carefully and properly performed, not only the quantity of the produce of the dairy will be greatly diminiſhed, but its quality alſo will be very much debaſed; for if all the milk be not thoroughly drawn from a cow when ſhe is milked, that portion of milk which is left in the udder ſeems to be gradually abſorbed into the ſyſtem, and nature generates no more than to ſupply the waſte of what has been taken away. If this leſſened quantity be not again thoroughly drawn off, it occaſions a yet farther diminution of the quantity of milk generated; and thus it may be made to

proceed

proceed in perpetual progreſſion, from little to leſs, till none at all is produced. In ſhort, this is the practice in all caſes followed, when it is meant to allow a cow's milk to dry up entirely, without doing her hurt. In this manner, therefore, the profits of a dairy might be wonderfully diminiſhed; ſo that it much behooves the owner of it to be extremely attentive to this circumſtance, if he wiſhes to avoid ruin. It ought to be a rule, without an exception, never to allow this important department to be intruſted, without controul, to the management of hired ſervants. Management of the Dairy.

Our author proceeds to enumerate the properties of a dairy. The milk-houſe ought to be cool in ſummer and warm in winter; ſo that an equal temperature may be preſerved throughout the year. It ought alſo to be dry, ſo as to admit of being kept ſweet and clean at all times. A ſeparate building ſhould be erected for the purpoſe, near a cool ſpring or running water, to which the cows may have eaſy acceſs, and where it is not liable to be incommoded by ſtagnant water. The apartment where the milk ſtands ſhould be well thatched, have thick walls, and a ventilator in the top for admitting a free circulation of air. There ſhould alſo be an apartment with a fire-place and caldron, for the purpoſe of ſcalding and cleaning the veſſels. The doctor is of opinion, that the temperature of from 50 to 55 degrees is the moſt proper for ſeparating the cream from the milk, and by proper means this might eaſily be kept up, or nearly ſo, both ſummer and winter. Dairy deſcribed.

The utenſils of the dairy ſhould be all made of wood, in preference either to lead, copper, or even caſt iron. Theſe metals are all very eaſily ſoluble in acids; the ſolutions of the two firſt are highly poiſonous; and though Wooden utenſils preferable to every other kind.

Management of the Dairy.

the latter is innocent, the taſte of it might render the products diſagreeable.

Having ſtated theſe general remarks upon the mode in which a dairy ought to be conducted, we ſhall next conſider its two valuable products, *butter* and *cheeſe*.

I. Of Butter.

Hiſtory of butter.

Butter, though uſed at preſent as food in moſt countries of Europe, was not known, or known very imperfectly, to the ancients. This, we think, is completely proved by Profeſſor Beckmann in the ſecond volume of his *Hiſtory of Inventions*. In our tranſlation of the Hebrew Scriptures, there is indeed frequent mention made of butter at very early periods; but, as the profeſſor well obſerves, the greateſt maſters of biblical criticiſm unanimouſly agree, that the word ſo tranſlated ſignifies milk or cream, or ſour thick milk, and cannot poſſibly mean what we call *butter*. The word plainly alludes to ſomething liquid, which was uſed for waſhing the feet, which was drank, and which had ſometimes the power of intoxicating; and we know that mares milk may be ſo prepared as to produce the ſame effect.

The oldeſt mention of butter, the profeſſor thinks, is in the account of the Scythians, given by Herodotus (lib. iv. 2.) who ſays, that "theſe people pour the milk of their mares into wooden veſſels, cauſe it to be violently ſtirred or ſhaken by their blind ſlaves, and ſeparate the part which ariſes to the ſurface, as they conſider it as more valuable and delicious than what is collected below it". That this ſubſtance muſt have been a ſoft kind of butter, is well known; and Hippocrates gives a ſimilar account of Scythian butter,

and

and calls it πικεριον, which Galen translates by the word βουτυρον. The poet Anaxandrides, who lived soon after Hippocrates, describing the marriage feast of Iphicrates, who married the daughter of Cotys king of Thrace, says, that the Thracians ate butter, which the Greeks at that time considered as a wonderful kind of food.

Management of the Dairy.

Dioscorides says, that good butter was prepared from the fattest milk, such as that of sheep or goats, by shaking it in a vessel till the fat was separated. To this butter he ascribes the same effects, when used externally, as those produced by our butter at present. He adds also, and he is the first writer who makes the observation, that fresh butter might be melted and poured over pulse and vegetables instead of oil, and that it might be employed in pastry in the room of other fat substances. A kind of soot likewise was at that time prepared from butter, for external applications, which was used in curing inflammation of the eyes and other disorders. For this purpose, the butter was put into a lamp, and, when consumed, the lamp was again filled, till the desired quantity of soot was collected in a vessel placed over it.

Galen, who distinguishes and confirms in a more accurate manner the healing virtues of butter, expressly remarks, that cows milk produces the fattest butter; that butter made from sheeps or goats milk is less rich; and that asses milk yields the poorest. He expresses his astonishment, therefore, that Dioscorides should say, that butter was made only from the milk of sheep and goats. He assures us, that he had seen it made from cows milk, and that he believes it had thence acquired its name. "Butter (says he) may be very

Management of the Dairy.

properly employed for ointments; and when leather is beſmeared with it, the ſame purpoſe is anſwered as when it is rubbed over with oil. In cold countries, which do not produce oil, butter is uſed in the baths; and that it is a real fat, may be readily perceived by its catching fire when poured over burning coals." What has been here ſaid is ſufficient to ſhew that butter muſt have been very little known to or uſed by the Greeks and Romans in the time of Galen, that is, at the end of the ſecond century.

The profeſſor having collected, in chronological order, every thing which he could find in the works of the ancients reſpecting butter, concludes, that it is not a Grecian, and much leſs a Roman invention; but that the Greeks were made acquainted with it by the Scythians, the Thracians, and the Phrygians; and the Romans by the people of Germany. He is likewiſe decidedly of opinion, that when theſe two poliſhed nations had learned the art of making it, they uſed it not as food, but only as an ointment, or ſometimes as a medicine. "We never find it (ſays he) mentioned by Galen and others as a food, though they have ſpoken of it as applicable to other purpoſes. No notice is taken of it by Apicius; nor is there any thing ſaid of it in that reſpect by the authors who treat on agriculture, though they have given us very particular information concerning milk, cheeſe, and oil."

The ancient Chriſtians of Egypt burnt butter in their lamps inſtead of oil; and in the Roman churches, it was anciently allowed, during Chriſtmas time, to burn butter inſtead of oil, on account of the great conſumption of it otherwiſe.

Qualities of butter.

Butter is the fat, oily, and inflammable part of the milk.

milk. This kind of oil is naturally diſtributed though all the ſubſtance of the milk in very ſmall particles, which are interpoſed betwixt the caſeous and ſerous parts, amongſt which it is ſuſpended by a ſlight adheſion, but without being diſſolved. It is in the ſame ſtate in which oil is in emulſions: hence the ſame whiteneſs of milk and emulſions; and hence, by reſt, the oily parts ſeparate from both theſe liquors to the ſurface, and form a cream. Management of the Dairy.

When butter is in the ſtate of cream, its proper oily parts are not yet ſufficiently united together to form a homogeneous maſs. They are ſtill half ſeparated by the interpoſition of a pretty large quantity of ſerous and caſeous particles. The butter is completely formed by preſſing out theſe heterogeneous parts by means of continued percuſſion. It then becomes an uniform ſoft maſs.

Freſh butter, which has undergone no change, has ſcarcely any ſmell; its taſte is mild and agreeable, it melts with a weak heat, and none of its principles are diſengaged by the heat of boiling water. Theſe properties prove, that the oily part of butter is of the nature of the fat, fixed, and mild oils, obtained from many vegetable ſubſtances by expreſſion.

Butter, however, as it is uſually prepared and ſold, is never in the ſtate of a pure oil. Even when the whole milk is moſt carefully and ſkilfully preſſed out of it, the oily parts continue united with a very putreſcible ſubſtance; this is the curd of the milk. Butter is poor in proportion to the quantity of curd or cheeſe that remains intimately united or attached to its oily particles. Cheeſe, on the contrary, is rich in proportion to the

Management of the Dairy.

quantity of the pure butter, or of the oily part of the milk, that remains attached to it.

Butter is uſed in food, on account of its agreeable taſte; but to be wholeſome, it muſt be very freſh and free from rancidity, and alſo not fried or burnt; otherwiſe its acrid and even cauſtic acid, being diſengaged, diſorders digeſtion, renders it difficult and painful, excites acrid empyreumatic belchings, and introduces much acrimony into the blood. Some perſons have ſtomachs ſo delicate, that they are even affected with theſe inconveniences by freſh butter and milk. This obſervation is alſo applicable to oil, fat, chocolate, and, in general, to all oleaginous matters.

Rules for making butter.

Dr James Anderſon, whom we have already quoted, gives the following minute directions for making and preſerving butter. The creaming diſhes, when properly cleaned, ſweet, and cool, ought to be filled with the milk as ſoon as it is drawn from the cow, having been firſt carefully ſtrained through a cloth, or cloſe ſtrainer made of hair or wire: the doctor prefers ſilver wire to every other. The creaming diſhes ought never to exceed three inches in depth; but they may be ſo broad as to contain a gallon and a half; when filled they ought to be put on the ſhelves of the milk-houſe, and remain there until the cream be fully ſeparated. If the fineſt butter be intended, the milk ought not to ſtand above ſix or eight hours, but for ordinary butter it may ſtand 12 hours or more; yet if the dairy be very large, a ſufficient quantity of cream will be ſeparated in two, three, or four hours, for making the beſt butter. It is then to be taken off as nicely as poſſible by a ſkimming diſh, without lifting any of the milk;

and

and immediately after put into a veſſel by itſelf, until a proper quantity for churning be collected. A firm, neat, wooden barrel, ſeems well adapted for this purpoſe, open at one end, and having a lid fitted to cloſe it. A cock or ſpigot ought to be fixed near the bottom, to draw off any thin or ſerous part which may drain from the cream; the inſide of the opening ſhould be covered with a bit of fine ſilver-wire gauze, in order to keep back the cream while the ſerum is allowed to paſs; and the barrel ſhould be inclined a little on its ſtand, to allow the whole to run off. Management of the Dairy.

The doctor contradicts the opinion, that very fine butter cannot be obtained, except from cream that is not above a day old. On the contrary, he inſiſts, that it is only in very few caſes, that even tolerably good butter can be obtained from cream that is not above one day old. The ſeparation of butter from cream only takes place after the cream has attained a certain degree of acidity. If it be agitated before that acidity has begun to take place, no butter can be obtained, and the agitation muſt be continued till the time that the ſourneſs is produced; after which the butter begins to form. "In ſummer, while the climature is warm, the heating may be, without very much difficulty, continued until the acidity be produced, ſo that butter may be got: but in this caſe the proceſs is long and tedious; and the butter is for the moſt part of a ſoft conſiſtence, and tough and gluey to the touch. If this proceſs be attempted during the cold weather in winter, butter can ſcarcely be in any way obtained, unleſs by the application of ſome great degree of heat, which ſometimes aſſiſts in producing a very inferior kind of butter, white, hard, and brittle, Cream ought to be kept ſome time before it be made into butter.

Management of the Dairy.

and almoſt unfit for any culinary purpoſe whatever. The judicious farmer, therefore, will not attempt to imitate this practice, but will allow his cream to remain in the veſſel appropriated for keeping it, until it has acquired the proper degree of acidity. There is no rule for determining how long it is to be kept; but our author is of opinion, that a very great latitude is allowable in this caſe; and that if no ſerous matter be allowed to lodge among the cream, it may be kept good for making butter a great many weeks.

Of the churn.

The churn in which butter is made likewiſe admits of conſiderable diverſity; but our author prefers the old-faſhioned upright churn to all others, on account of its being more eaſily cleaned. The labour, when the cream is properly prepared, he thinks, very trifling. Much greater nicety, he ſays, is required in the proceſs of churning than moſt people are aware of; as a few haſty and irregular ſtrokes will render butter bad, which otherwiſe would have been of the fineſt quality. After the proceſs is over, the whole ought to be ſeparated from the milk, and put into a clean diſh, the inſide of which, if made of wood, ought to be well rubbed with common ſalt, to prevent the butter from adhering to it. The butter ſhould be preſſed and worked with a flat wooden ladle or ſkimming diſh, having a ſhort handle, ſo as to force out all the milk that was lodged in the cavities of the maſs. This operation requires a conſiderable degree of ſtrength as well as dexterity; but our author condemns the beating up of the butter with the hand as "an indelicate and barbarous practice." In like manner he condemns the employing of cold water in this operation, to *waſh* the butter as it is called. Thus, he ſays, the quality of it is de-

Butter ought not to be put into water.

abſed

baſed in an aſtoniſhing degree. If it is too ſoft, it may be put into ſmall veſſels, and theſe allowed to ſwim in a tub of cold water; but the water ought never to touch the butter. The beating ſhould be continued till the milk be thoroughly ſeparated, but not till the butter become tough and gluey; and after this is completely done, it is next to be ſalted. The veſſel into which it is to be put muſt be well ſeaſoned with boiling water ſeveral times poured into it: the inſide is to be rubbed over with common ſalt, and a little melted butter poured into the cavity between the bottom and ſides, ſo as to make it even with the bottom; and it is then fit for receiving the butter. Inſtead of common ſalt alone, the doctor recommends the following compoſition: "Take of ſugar one part; of nitre one part; and of the beſt Spaniſh great ſalt, two parts. Beat the whole into fine powder, mix them well together, and put them by for uſe. One ounce of this is to be thoroughly mixed with a pound of butter as ſoon as it is freed from the milk, and then immediately put into the veſſel deſigned to hold it; after which it muſt be preſſed ſo cloſe as to leave no air-holes; the ſurface is to be ſmoothed and covered with a piece of linen, and over that a piece of wet parchment; or, in defect of this laſt, fine linen that has been dipped in melted butter, exactly fitted to the edges of the veſſel all round, in order to exclude the air as much as poſſible. When quite full, the caſk is to be covered in like manner, and a little melted butter put round the edges, in order to fill up effectually every cranny, and totally to exclude the air. "If all this (ſays the doctor) be carefully done, the butter may be kept perfectly ſound in this climate for many years; How many years I cannot

Management of the Dairy.

Compoſition for preſerving butter.

Management of the Dairy.

not tell; but I have ſeen it two years old, and in every reſpect as ſweet and ſound as when only a month old. It deſerves to be remarked, that butter cured in this manner does not taſte well till it has ſtood at leaſt a fortnight after being ſalted; but after that period is elapſed, it eats with a rich marrowy taſte that no other butter ever acquires; and it taſtes ſo little of ſalt, that a perſon who had been accuſtomed to eat butter cured with common ſalt only, would not imagine it had got one-fourth part of the ſalt neceſſary to preſerve it." Our author is of opinion, that ſtrong brine may be uſeful to pour upon the ſurface during the time it is uſing, in order the more effectually to preſerve it from the air, and to avoid rancidity.

To prepare butter for ſending to warm climates.

As butter contains a quantity of mucilaginous matter much more putreſcible than the pure oily part, our author recommends the purifying it from this mucilage by melting in a conical veſſel, in which the mucilage will fall to the bottom; the pure oily part ſwimming at top. This will be uſeful, when butter is to be ſent a long voyage to warm climates, as the pure part will keep much better than when mixed with the other. He propoſes another method of preſerving butter, by mixing it with honey, which is very antiſeptic, and mixes intimately with the butter. Thus mixed, it eats very pleaſantly, and may perhaps be ſucceſsfully uſed with a medicinal intention.

Preſerved by honey.

Epping butter.

In England no butter is eſteemed equal to that which is made in the county of Eſſex, well known by the name of *Epping butter*, and which in every ſeaſon of the year yields at London a much higher price than any other. The following directions concerning the making and management of butter, including the Epping method

thod

thod, are extracted from the 3d volume of the Bath Society Papers. Management of the Dairy.

It ſometimes happens that ſome of a cow's teats may be ſcratched or wounded ſo as to produce foul or corrupted milk; when this is the caſe, we ſhould by no means mix it with the ſweet milk, but give it to the pigs; and that which is conveyed to the dairy-houſe ſhould remain in the pail till it is nearly cool, before it be ſtrained, that is, if the weather be warm; but in froſty weather it ſhould be immediately ſtrained, and a ſmall quantity of boiling water may be mixed with it, which will cauſe it to produce cream in abundance, and the more ſo if the pans or vats have a large ſurface.

During the hot ſummer months, it is right to riſe with or before the ſun, that the cream may be ſkimmed from the milk ere the dairy becomes warm; nor ſhould the milk at that ſeaſon ſtand longer in the vats, &c. than 24 hours, nor be ſkimmed in the evening till after ſunſet. In winter, milk may remain unſkimmed for 36 or 48 hours; the cream ſhould be depoſited in a deep pan, which ſhould be kept during the ſummer in the cooleſt part of the dairy; or in a cool cellar where a free air is admitted, which is ſtill better. Where people have not an opportunity of churning every other day, they ſhould ſhift the cream daily into clean pans, which will keep it cool, but they ſhould never fail to churn, at leaſt twice in the week, in hot weather; and this work ſhould be done in a morning before the ſun appears, taking care to fix the churn where there is a free draught of air. If a pump-churn be to be uſed, it may be plunged a foot deep into a tub of cold water, and ſhould remain there during the whole time

Management of the Dairy.

time of churning, which will very much harden the butter. A ſtrong rancid flavour will be given to butter, if we churn ſo near the fire as to heat the wood in the winter ſeaſon.

After the butter is churned, it ſhould be immediately waſhed in many different waters till it is perfectly cleanſed from the milk; but here it muſt be remarked, that a warm hand will ſoften it, and make it appear greaſy, ſo that it will be impoſſible to obtain the beſt price for it. The cheeſemongers uſe two pieces of wood for their butter; and if thoſe who have a very hot hand were to have ſuch, they might work the butter ſo as to make it more ſaleable.

The Epping butter is made up for market in long rolls, weighing a pound each. In the county of Somerſet, they diſh it in half pounds for ſale; but if they forget to rub ſalt round the inſide of the diſh, it will be difficult to work it ſo as to make it appear handſome.

Thoſe who uſe a pump-churn muſt endeavour to keep a regular ſtroke; nor ſhould they admit any perſon to aſſiſt them, except they keep nearly the ſame ſtroke; for if they churn more ſlowly, the butter will in the winter *go back*, as it is called; and if the ſtroke be more quick and violent in the ſummer, it will cauſe a fermentation, by which means the butter will imbibe a very diſagreeable flavour.

Where people keep many cows, a barrel-churn is to be preferred; but if this be not kept very clean, the bad effects will be diſcovered in the butter; nor muſt we forget to ſhift the ſituation of the churn when we uſe it, as the ſeaſons alter, ſo as to fix it in a warm

place

place in winter, and where there is a free air in ſummer.

In many parts of this kingdom they colour their butter in winter, but this adds nothing to its goodneſs; and it rarely happens that the farmers in or near Epping uſe any colour; but when they do, it is very innocent. They procure ſome ſound carrots, whoſe juice they expreſs through a ſieve, and mix with the cream when it enters the churn, which makes it appear like May butter; nor do they at any time uſe much ſalt, though a little is abſolutely neceſſary.

As they make in that country but very little cheeſe, ſo of courſe very little whey butter is made; nor indeed ſhould any perſon make it, except for preſent uſe, as it will not keep good more than two days; and the whey will turn to better account to fatten pigs with. Nothing feeds theſe faſter, nor will any thing make them ſo delicately white. At the ſame time it is to be obſerved, that no good bacon can be made from pigs thus fatted. Where much butter is made, good cheeſe for ſervants may be obtained from ſkimmed milk, and the whey will afterwards do for ſtore pigs.

Cows ſhould never be ſuffered to drink improper water; ſtagnated pools, water wherein frogs, &c. ſpawn, common ſewers, and ponds that receive the drainings of ſtables, are improper.

How butter may be kept untainted by cabbages and turnips.

In the Annals of Agriculture, vol. xvii. the following mode of preventing butter and cream from receiving a taint from the cows feeding on cabbages and turnips is ſtated by J. Jones, Eſq. of Bolas-heath, Newport, Shropſhire. "I find by experience (ſays he) that a ſmall bit of ſaltpetre, powdered and put into the milk-pan, with the new milk, does effectually prevent the cream and butter

butter from being tainted, although the cows be fed on the refuſe leaves of cabbages and turnips. In the beginning of this laſt winter, my men were very careful in not giving to the cows any outſide or decayed leaves of the cabbages or turnips; yet the cream and butter were ſadly tainted: but as ſoon as the maid uſed the ſaltpetre, all the taint was done away; and afterwards no care was taken in feeding the cows, for they had cabbages and turnips in all ſtates. Our milk-pans hold about nine pints of milk."

2. Of Cheese.

Cheeſe deſcribed.

The other grand object of the dairy is cheeſe-making. Cheeſe is the curd of milk, precipitated or ſeparated from the whey by an acid. Cheeſe differs in quality according as it is made from new or ſkimmed milk, from the curd which ſeparates ſpontaneouſly upon ſtanding, or that which is more ſpeedily produced by the addition of runnet. Cream alſo affords a kind of cheeſe, but quite fat and butyraceous, and which does not keep long. Analyzed chemically, cheeſe appears to partake much more of an animal nature than butter, or the milk from which it was made. It is inſoluble in every liquid except ſpirit of nitre, and cauſtic alkaline ley. Shaved thin, and properly treated with hot water, it forms a very ſtrong cement if mixed with quicklime. When prepared with the hot water, it is recommended in the Swediſh memoirs to be uſed by anglers as a bait. It may be made into any form, is not ſoftened by the cold water, and the fiſhes are fond of it. As a food, phyſicians condemn the too free uſe of cheeſe. When new, it is extremely difficult of digeſtion: when old, it becomes acrid and hot; and, from

from Dr Percival's experiments, is evidently of a ſeptic nature. It is a common opinion that old cheeſe digeſts every thing, yet is left undigeſted itſelf: but this is without any ſolid foundation. Cheeſe made from the milk of ſheep is digeſted ſooner than that from the milk of cows, but is leſs nouriſhing; that from the milk of goats digeſts ſooner than either, but is alſo the leaſt nouriſhing. In general, it is a kind of food fit only for the laborious, or thoſe whoſe organs of digeſtion are ſtrong. Management of the Dairy.

Every country has places noted for this commodity: thus Cheſter and Glouceſter cheeſe are celebrated in England; and the Parmeſan cheeſe is in no leſs repute abroad, eſpecially in France. This ſort of cheeſe is entirely made of ſweet cow-milk: but at Rochefort in Languedoc, they make it of ewes milk; and in other places it is uſual to add goat or ewes milk in a certain proportion to that of the cow. There is likewiſe a kind of medicated cheeſe made by intimately mixing the expreſſed juice of certain herbs, as ſage, baum, mint, &c. with the curd before it is faſhioned into a cheeſe. The Laplanders make a ſort of cheeſe of the milk of their rein-deer; which is not only of great ſervice to them as food, but on many other occaſions. It is a very common thing in theſe climates to have a limb numbed and frozen with the cold: their remedy for this is heating an iron red hot, and thruſting it through the middle of one of theſe cheeſes: they catch what drops out, and with this anoint the limb, which ſoon recovers. They are ſubject alſo to coughs and diſeaſes of the lungs, and theſe they cure by the ſame ſort of medicine: they boil a large quantity of the cheeſe in the freſh deer's milk, and drink the decoc-

tion

Management of the Dairy.

tion in large draughts warm ſeveral times a-day. They make a leſs ſtrong decoction of the ſame kind alſo, which they uſe as their common drink, for three or four days together, at ſeveral times of the year. They do this to prevent the miſchiefs they are liable to from their water, which is otherwiſe their conſtant drink, and is not good

Making of cheeſe.

In making cheeſe the ſame precaution is to be obſerved as with regard to butter, viz. the milk ought not to be agitated by carrying to any diſtance; nor ought the cows to be violently driven before they are milked, which reduces the milk almoſt to the ſame ſtate as if agitated in a barrel or churn. To this cauſe Mr Twamley, who has written a treatiſe upon dairy management, attributes the great difficulty ſometimes met with in making the milk coagulate; four or five hours being ſometimes neceſſary inſtead of one (the uſual time employed); and even after all, the curd will be of ſuch a ſoft nature, that the cheeſe will ſwell, puff up, and rent in innumerable places, without ever coming to that ſolid conſiſtence which it ought to have. As this frequently happens in conſequence of heat, Mr Twamley adviſes to mix a little cold ſpring water with the milk. It is a bad practice to put in more runnet when the curd appears difficult to be formed; for this ſubſtance, after having once formed the curd by the uſe of a certain quantity, will diſſolve it again by the addition of more.

General defects of cheeſe.

The moſt common defects of cheeſe are its appearing when cut, full of ſmall holes called *eyes*; its puffing up, cracking, and pouring out quantities of thin ſerous liquor; becoming afterwards rotten and full of maggots in thoſe places from which the liquor iſſued. All this,

this, according to our author, proceeds from the formation of a ſubſtance called by him *ſlip curd*, a kind of half coagulum, incapable of a thorough union with the true curd, and which, when broken into very ſmall bits, produces *eyes*; but if in larger pieces, occaſions thoſe rents and cracks in the cheeſe already mentioned: for though this kind of curd retains its coagulated nature for ſome time, it always ſooner or later diſſolves into a ſerous liquid. This kind of curd may be produced, 1. By uſing the milk too hot. 2. By bad runnet. 3. By not allowing the curd a proper time to form. The firſt of theſe is remedied by the uſe of cold water, which our author ſays is ſo far from being detrimental to the quality of the cheeſe, that it really promotes the action of the runnet upon the milk. The ſecond, viz. a knowledge of good and bad runnet, can only be acquired by long practice; and no particular directions can be given, farther than that the utmoſt care muſt be taken that it have no putrid tendency, nor any rancidity from too great heat in drying. The only rule that can be given for its preparation is to take out the maw of a calf which has fed entirely upon milk; after it is cold, ſwill it a little in water; rub it well with ſalt; then fill it with the ſame, and afterwards cover it. Some cut them open and ſpread them in ſalt, putting them in layers above one another, letting them continue in the brine they produce, ſometimes ſtirring or turning them for four, ſix, or nine months; after which they are opened to dry, ſtretched out upon ſticks or ſplints. They may be uſed immediately after being dried, though it is reckoned beſt to keep them till they be a year old before they are uſed. The beſt method of making the runnet from

Management of the Dairy.

Of preparing runnet.

Management of the Dairy.

the ſkins, according to our author, is the following: "Take pure ſpring water, in quantity proportioned to the runnet you intend to make; it is thought beſt by ſome two ſkins to a gallon of water; boil the water, which makes it ſofter and more pure; make it with ſalt into brine that will ſwim an egg: then let it ſtand till the heat is gone off to about the heat of blood-warm; then put your maw-ſkin in, either cut in pieces or whole; the former I ſhould imagine beſt or moſt convenient; letting it ſteep 24 hours, after which it will be fit for uſe. Such quantity, as is judged neceſſary, muſt then be put into the milk; about a tea-cupful being neceſſary for ten cows milk; though, in this reſpect, very particular directions cannot be given."

Mr Hazard's receipt for runnet.

In the Bath Papers, Mr Hazard gives the following receipt for making runnet. "When the maw-ſkin is well prepared and fit for the purpoſe, three pints or two quarts of ſoft water, clean and ſweet, ſhould be mixed with ſalt, wherein ſhould be put ſweet brier, roſe leaves and flowers, cinnamon, cloves, mace, and in ſhort, almoſt every ſort of ſpice and aromatic that can be procured; and if theſe are put into two quarts of water, they muſt boil gently till the liquor is reduced to three pints, and care ſhould be taken that this liquor is not ſmoked. It ſhould be ſtrained clear from the ſpices, &c. and when found not to be warmer than milk from the cow, it ſhould be poured upon the vell or maw. A lemon may then be ſliced into it, when it may remain a day or two; after which it ſhould be ſtrained again and put into a bottle, where, if well corked, it will keep good for twelve months or more. It will ſmell like a perfume, and a ſmall quantity of it will turn the milk, and give the cheeſe a pleaſing flavour."

vour." He adds, that if the vell or maw be ſalted, and dried for a week or two near the fire, it will do for the purpoſe again almoſt as well as before. Management of the Dairy.

In the making of cheeſe, ſuppoſing the runnet to be of a good quality, the following particulars muſt be obſerved: 1. The proper degree of heat. This ought to be what is called *milk-warm*, or, "a few degrees removed from coolneſs," according to Mr Twamley; conſiderably below the heat of milk taken from the cow. If too hot, it may be reduced to a proper temperature by cold water, as already mentioned. 2. The time allowed for the runnet to take effect. This, our author obſerves, ought never to be leſs than an hour and a half. The proceſs may be accelerated, particularly by putting ſalt to the milk before the runnet is added. Mr Twamley adviſes two handfuls to ten or twelve cows milk; but he aſſures us, that no bad conſequence can follow from the curd being formed ever ſo ſoon; as it then only becomes more ſolid and fit for making cheeſe of a proper quality. 3. To prevent any difficulty in ſeparating the curd from the whey, prepare a long cheeſe-knife from lath; one edge being ſharpened to cut the curd acroſs from top to bottom in the tub, croſſing it with lines checkerwiſe: by which means the whey riſes through the vacancies made by the knife, and the curd ſinks with much more eaſe. A ſieve has alſo been uſed with ſucceſs, in order to ſeparate the whey perfectly from the curd. 4. Having got the curd all firm at the bottom of the tub, take the whey from it; let it ſtand a quarter of an hour to drain before you put it into the vat to break it. If any bits of ſlip-curd ſwim among the whey, pour it all off together rather than Particulars to be obſerved in making of cheeſe.

Management of the Dairy.

put it among the cheeſe, for the reaſons already given. Some dairy-women allow the curd to ſtand for two hours; by which time it is become of ſo firm a nature that no breaking is neceſſary: they have only to cut it in ſlices, put it into the vat, and work it well by ſqueezing thoroughly to make it ſit cloſe; then put it into the preſs. Our author, however, approves more of the method of breaking the curd, as leſs apt to make the cheeſe hard and horny. 5. When the whey is of a white colour, it is a certain ſign that the curd has not ſubſided; but if the method juſt now laid down be followed, the whey will always be of a green colour; indeed this colour of the whey is always a certain criterion of the curd having been properly managed. 6. The beſt method of preventing cheeſe from heaving, is to avoid making the runnet too ſtrong, to take care that it be clean, and not tainted; to be certain that the curd is fully come, and not to ſtir it before the air has had time to eſcape; a quantity of air being always diſcharged in this as in many other chemical proceſſes. 7. Cheeſe is very apt to ſplit in conſequence of being "ſalted within," eſpecially when the vat is about half filled. In this caſe the curd, though ſeparated only in a ſmall degree by the ſalt, never cloſes or joins as it ought to do. Mr Twamley prefers ſalting in the milk greatly to this method. 8. Dry cracks in cheeſe are generally produced by keeping curd from one meal to another, and letting the firſt become too ſtiff and hard before it is mixed with the other. 9. Curdly or wrinkle-coated cheeſe is cauſed by ſour milk. Cheeſe made of cold milk is apt to be hard, or to break and fly before the knife. 10. Such coated cheeſe is cauſed by being made

made too cold, as cheeſe that is made in winter or late in autumn is apt to be, unleſs laid in a warm room after it is made. Management of the Dairy.

Cheeſe is of very different quality, according to the milk from which it is made. Thus, in Glouceſterſhire, what is called the *ſecond* or *two-meal* cheeſe, is made from one meal of new milk and one of ſkimmed or old milk, having the cream taken away. Skimmed cheeſe, or *ſlet-milk* cheeſe, is made entirely from ſkimmed milk, the cream having been taken off to make butter. It goes by the name of *Suffolk cheeſe*, and is much uſed at ſea; being leſs liable to be affected by the heat of warm climates than the other kinds. A great deal of difference, however, is to be obſerved in the quality of it, which our author ſuppoſes to ariſe chiefly from greater care being taken in ſome places than in others. Different kinds of cheeſe.

Slip-coat or ſoft cheeſe is made entirely of ſlip-curd, and diſſolves into a kind of creamy liqour; which is a demonſtration of the nature of this curd, as already mentioned. It is commonly computed, that as much milk is required to make one pound of butter as two of cheeſe; and even more where the land is poor, and the paſtures afford but little cream.

Beſt methods of making cheeſe in England. The double Glouceſter is a cheeſe that pleaſes almoſt every palate. The beſt of this kind is made from new, or (as it is called in that and the adjoining counties) *covered milk*. An inferior ſort is made from what is called *half-covered milk*; though when any of theſe cheeſes turn out to be good, people are deceived, and often purchaſe them for the beſt *covered milk cheeſe*, but farmers who are honeſt have them ſtamped with a piece of wood Double Glouceſter.

Manage-ment of the Dairy.

made in the ſhape of a heart, ſo that any perſon may know them.

It will be every farmer's intereſt (if he has a ſufficient number of cows) to make a large cheeſe from one meal's milk. This, when brought in warm, will be eaſily changed or turned with the runnet; but if the morning or night's milk be to be mixed with that which is freſh from the cow, it will be a longer time before it turns; nor will it change ſometimes without being heated over the fire, by which it often gets duſt or ſoot, or ſmoke, which will give the cheeſe a very diſagreeable flavour.

When the milk is turned, the whey ſhould be carefully ſtrained from the curd. The curd ſhould be broken ſmall with the hands; and when it is equally broken, it muſt be put by a little at a time into the vat, carefully breaking it as it is put in. The vat ſhould be filled an inch or more above the brim, that when the whey is preſſed out, it may not ſhrink below the brim; if it does, the cheeſe will be worth very little. But firſt, before the curd is put in, a cheeſe-cloth or ſtrainer ſhould be laid at the bottom of the vat: and this ſhould be ſo large, that when the vat is filled with the curd, the ends of the cloth may turn again over the top of it. When this is done, it ſhould be taken to the preſs, and there remain for the ſpace of two hours, when it ſhould be turned, and have a clean cloth put under it, and turned over as before. It muſt then be preſſed again, and remain in the preſs ſix or eight hours; when it ſhould again be turned and rubbed on each ſide with ſalt. After this it muſt be preſſed again for the ſpace of 12 or 14 hours more; when, if any of the edges project, they ſhould be pared off: it may

then

then be put on a dry board, where it ſhould be regularly turned every day. It is a good way to have three or four holes bored round the lower part of the vat, that the whey may drain ſo perfectly from the cheeſe as not the leaſt particle of it may remain. Management of the Dairy.

The prevailing opinion of the people of Glouceſterſhire and the neighbouring counties is, that the cheeſes will ſpoil if they do not ſcrape and waſh them when they are found to be mouldy. But others think, that ſuffering the mould to remain mellows them, provided they are turned every day. Thoſe, however, who will have the mould off, ſhould cauſe it to be removed with a clean dry flannel, as the waſhing the cheeſe is only a means of making the mould (which is a ſpecies of fungus rooted in the coat) grow again immediately.

Some people ſcald the curd, but this is a bad and mercenary practice; it robs the cheeſe of its fatneſs, and can only be done with a view to raiſe a greater quantity of whey butter, or to bring the cheeſes forward for ſale, by making them appear older than they really are.

As moſt people like to purchaſe high-coloured cheeſe, it may be right to mix a little arnotto with the milk before it is turned. No cheeſe will look yellow without it; and though it does not in the leaſt add to the goodneſs, it is perfectly innocent in its nature and effects.

Cheſhire cheeſe is much admired; yet no people take leſs pains with the runnet than the Cheſhire farmers. Cheſhire cheeſe.

The following account of the mode of making this cheeſe is ſtated in the Annals of Agriculture, by Mr

Management of the Dairy.

John Chamberlaine of Chefter. "The proceſs of making Cheſhire cheeſe is as follows, viz. on a farm capable of keeping 25 cows, a cheeſe of about ſixty pounds weight may be daily made, in the months of May, June, and July.

"The evening's milk is kept untouched until next morning, when the cream is taken off, and put to warm in a braſs pan heated with boiling water; then one-third part of that milk is heated in the ſame manner, ſo as to bring it to the heat of new milk from the cow; (This part of the buſineſs is done by a perſon who does not aſſiſt in milking the cows during that time.) Let the cows be milked early in the morning; then the morning's new milk and the night's milk, thus prepared, are put into a large tub together with the cream; then a portion of runnet, that has been put into water milk-warm the evening before, is put into the tub, ſufficient to coagulate the milk; and, at the ſame time, if arnotto be uſed to colour the cheeſe, a ſmall quantity, as requiſite for colouring, (or a marigold or carrot infuſion) is rubbed very fine, and mixed with the milk, by ſtirring all together; then covering it up warm, it is to ſtand about half an hour, or until coagulated; at which time it is firſt turned over with a bowl, to ſeparate the whey from the curds, and broken ſoon after with the hand and bowl into very ſmall particles; the whey being ſeparated by ſtanding ſome time, is taken from the curd, which ſinks to the bottom. The curd is then collected into a part of the tub which has a ſlip or looſe board acroſs the diameter of the bottom of it, for the ſole uſe of ſeparating them; and a board is placed thereon, with weights, from ſixty to a hundred and twenty pounds, to preſs out the whey. When

it

it is getting into a more ſolid conſiſtence, it is cut, and turned over in ſlices ſeveral times, to extract all the whey, and then weighted as before; which operations may take up about an hour and a half. It is then taken from the tub, as near the ſide as poſſible, and broken very ſmall by hand, and ſalted, and put into a cheeſe vat, enlarged in depth by a tin hoop to hold the quantity, it being more than bulk when finally put into the preſs. Then preſs the ſide well by hand, and with a board at top well weighted; and placing wooden ſkewers round the cheeſe to the centre, and drawing them out frequently, the upper part of the cheeſe will be drained of its whey: then ſhift it out of the vat; firſt put a cloth upon the top of it, and reverſe it on the cloth into another vat, or the ſame, which vat ſhould be well ſcalded before the cheeſe is returned into it; then the top part is broken by hand down to the middle, and ſalt mixed with it, and ſkewered as before; then preſſed by hand, weighted, and all the whey extracted. This done, reverſe the cheeſe again into another vat, warmed as before, with a cloth under it; then a tin hoop or binder is put round the upper edge of the cheeſe and within the ſides of the vat, the cheeſe being firſt incloſed in a cloth, and the edges of it put within the vat. Management of the Dairy.

"N. B. The cloth is of fine hemp, one yard and a half long by one yard wide. It is ſo laid, that on one ſide of the vat it ſhall be level with the ſide of it, on the other it ſhall lap over the whole of the cheeſe, and the edges put within the vat: and the tin fillet to go over the whole. All the above operations will take from ſeven in the morning till one at noon. Finally, it is put into a preſs of fifteen or twenty cwt. and

ſtuck

Management of the Dairy.

ſtuck round the vat into the cheeſe with thin wire ſkewers, which are ſhifted occaſionally. In four hours more, it ſhould be ſhifted and turned; and in four hours more, the ſame, and the ſkewering continued. Next morning, let it be turned by the woman who attends the milk, and put under another or the ſame preſs, and ſo turned at night and the next morning; at noon taken out finally to the ſalting room, there ſalt the outſide, and put a cloth binder round it. The cheeſe ſhould, after ſuch ſalting, be turned twice a-day for ſix or ſeven days, then left two or three weeks to dry, turned and cleaned every day, taken to the common cheeſe room, laid on ſtraw on a boarded floor, and daily turned until grown hard.

"The room ſhould be moderately warm; but no wind or draught of air ſhould be permitted, which generally cracks them. Some rub the outſides with butter or oil to give them a coat.

"The ſpring-made cheeſe is often ſhipped for the London market in the following autumn, and it is ſuppoſed to be much ameliorated by the heating on board the veſſel."

We ſhall add the account given by Mr Thomas Wedge, of the manner in which they manage in Cheſhire the whey that is preſſed from the cheeſe, out of which they extract what is called *whey butter* *. "Green whey is the clear whey which is taken from the curd out of the cheeſe tub: the white whey is what is preſſed out of the curd by the hand, &c. after being put into the cheeſe vat: the general term of whey is given only

* *Annals of Agriculture*, vol. xxviii.

only to ſuch part of the liquid as remains after the fleetings (made by ſcalding the whey) have been ſkimmed therefrom. In the proceſs of making whey butter, in ſome inſtances, the (thruſtings) or white whey is ſet in cream mugs to acidulate for churning, either by the warmth of the ſeaſon, or of a room, in the ſame manner as for making milk butter. In other inſtances, the green and white whey are both boiled together for fleetings (the account of which follows): In this caſe, or when the green whey is boiled alone (the boiler, if an iron one, being previouſly rubbed with butter, to prevent the whey from catching or acquiring a burnt-like taſte), ſuch a fire is kept as will make the whey as hot as poſſible, without boiling; and as ſoon as they have acquired that degree of heat, the buttery matter, which the whey contains, will break, or ſeparate from it, and riſe to the ſurface. This generally takes place in the courſe of about an hour; but when the whey is perfectly ſweet, a little ſouring is ſometimes added to produce the breaking effect. In other reſpects the proceſs of making whey-butter is the ſame as that of milk-butter.

" *Scalding Whey.*—The whey, when taken out of the cheeſe tub into braſs bans or other convenient veſſels, is ſuffered to ſtand about a quarter of an hour; when it is put out into other veſſels, in which veſſels it ſtands as long, and is then poured into the furnace pan. In each of theſe intervals it depoſits a ſediment of curd, which is collected in the bottom of the veſſels, and returned to the maſs of curd in the cheeſe tub.

" That whey, which drips into the tub while the cheeſe is preſſed over it, is always kept by itſelf, and ſet by till it is, at leaſt, a day old; as ſoon, therefore,

Management of the Dairy.

fore, as the green whey in the furnace pan becomes ſo hot, as to throw up a little white froth or foam (it muſt not boil) the thruſtings of the preceding day are put into it (unleſs, as before ſtated, they are otherwiſe diſpoſed of). Theſe cauſe the whey to break, and throw up a ſubſtance, ſomething in appearance between cream and curd, which is conſtantly ſkimmed off as long as it riſes, and put into the cream mugs to be churned for butter.

This whey cream, as it is called, is churned up thrice a-week, and the average produce of butter, which it yields, from one dairy cow, is from eight to ten ounces weekly. The difference of price between this and milk butter is generally from one penny to twopence per pound. As ſoon as the whey is exhauſted of its cream, about two quarts of butter-milk are poured into it, which again breaks into what are called *fleetings* or *flit-milk*, and theſe are ſkimmed off for the uſe of the ſervants, &c.

Stilton cheeſe.

But of all the cheeſe this kingdom produces, none is more highly eſteemed than the Stilton, which is called the *Parmeſan* of England, and (except faulty) is never ſold for leſs than 1s. or 1s. 2d. per pound.

The Stilton cheeſes are uſually made in ſquare vats, and weigh from ſix to twelve pounds each cheeſe. Immediately after they are made, it is neceſſary to put them into ſquare boxes made exactly to fit them; they being ſo extremely rich, that, except this precaution be taken, they are apt to bulge out, and break aſunder. They ſhould be continually and daily turned in theſe boxes, and muſt be kept two years before they are properly mellowed for ſale.

Some make them in a net ſomewhat like a cabbage net;

net; ſo that they appear, when made, not unlike an acorn. But theſe are never ſo good as the other, having a thicker coat, and wanting all that rich flavour and mellowneſs which make them ſo pleaſing. Management of the Dairy.

It is proper to mention, that the making of theſe cheeſes is not confined to the Stilton farmers, as many others in Huntingdonſhire (not forgetting Rutland and Northamptonſhire) make a ſimilar ſort, ſell them for the ſame price, and give all of them the name of *Stilton cheeſes*.

Though theſe farmers are remarked for cleanlineſs, they take very little pains with the runnet, as they in general only cut pieces from the vell or maw, which they put into the milk, and move gently about with the hand, by which means it breaks or turns it ſo, that they eaſily obtain the curd. They make a cheeſe every morning; and to this meal of new milk they add the cream taken from that which was milked the night before. This, and the age of their cheeſes, have been ſuppoſed the only reaſons why they are preferred to others; for, from the niceſt obſervations, it does not appear that their land is in any reſpect ſuperior to that of other counties.

Excellent cream cheeſes are made in Lincolnſhire, by adding the cream of one meal's milk to milk which comes immediately from the cow; theſe are preſſed gently two or three times, turned for a few days, and are then diſpoſed of at the rate of 1s. per pound, to be eaten while new with radiſhes, ſalad, &c.

Many people give ſkimmed milk to pigs, but the whey will do equally well after cheeſes are made from this milk; ſuch cheeſes will always ſell for, at leaſt, 2d. per pound, which will amount to a large ſum annually, where

Management of the Dairy.

where they make much butter. The peaſants and many of the farmers in the north of England never eat any better cheeſe; and though they appear harder, experience hath proved them to be much eaſier of digeſtion than any new milk cheeſes. A good market may always be found for the ſale of them at Briſtol.

Parmeſan cheeſe.

Account of the making of Parmeſan Cheeſe by Mr Zappa of Milan, in anſwer to Queries from Arthur Young, Eſq.

From the middle of April, or ſooner if poſſible, the cows are ſent to paſture in the meadows till the end of November uſually. When the ſeaſon is paſt, and ſnow comes, they are put into ſtables for the whole winter, and fed with hay. Between nine and ten in the morning the cows are ſent to water, and then to the paſtures, where they remain four or five hours at moſt, and at three or four o'clock are driven to the ſtables, if the ſeaſon is freſh, or under porticoes, if hot; where for the night, a convenient quantity of hay is given them. No owner will leave his cattle, without great cauſe, in uncovered places at night. It happens only to the ſhepherds from the Alps, when they paſs, becauſe it is impoſſible to find ſtables for all their cattle. For a dairy farm of 100 cows, which yields daily a cheeſe weighing 70 or 75 lb. of 28 ounces, are wanted 1000 perticas of land. Of theſe about 800 are ſtanding meadows, the other 200 are in cultivation for corn and graſs fields in rotation. Thoſe that are in milk are milked morning and evening, with exception of ſuch as are near calving.

The 100 cows form a dairy farm of a good large cheeſe;

cheeſe; it is reckoned, that 80 are in milk, and 20 with calves ſucking, or near calving. They reckon one with the other about 32 boccalis of 32oz. of milk. Such is the quantity for a cheeſe of about 70lb. of 28 ounces. They join the evening with the morning milk, becauſe it is freſher than if it was that of the morning and evening of the ſame day. The morning milk would be 24 hours old when the next morning the cheeſe ſhould be made. From the evening milk all the cream poſſible is taken away for butter, maſcarponi (cream cheeſe), &c. The milk of the morning ought to be ſkimmed ſlightly; but every one ſkims as much cream as he can. The butter is ſold on the ſpot immediately at 24 ſous; the cheeſe at about 28 ſous. The butter loſes nothing in weight; the cheeſe loſes one-third of it, is ſubject to heat, and requires expences of ſervice, attention, warehouſes, &c. before it is ſold; and a man in two hours makes 45 or 50lb. of butter that is ſold directly. However, it is not poſſible to leave much cream in the milk to make Lodeſan cheeſe, called *grained cheeſe*; becauſe if it is too rich, it does not laſt long, and it is neceſſary to conſume it while young and ſound. Management of the Dairy.

"Parmeſan or Lodeſan cheeſe is made every day in the year with 100 cows. In winter, however, the milk being leſs in quantity, the cheeſe is of leſſer weight, but certainly more delicate. The morning of the 3d of March 1786, I have ſeen the whole operation, having gone on purpoſe to the ſpot to ſee the whole work from beginning to the end. At 16 Italian hours, or ten in the morning, according to the northern way to account hours, the ſkimming of that morning's milk, gathered only two hours before, was finiſhed. I did, meanwhile, examine

Management of the Dairy.

examine the boiler or pot. At the top it was eight feet (Engliſh) diameter, or thereabout; and about five feet three inches deep, made like a bell, and narrowing towards the bottom to about two and one-half feet. They joined the cream produced that morning with the other produced by the milk of the evening before. That produced by the laſt milk was double in quantity to that of the morning milk, becauſe it had the whole night to unite; and that of the morning had only two hours to do it, in which it could not ſeparate much. Of the cream, ſome was deſtined to make maſcarponies (cream cheeſe), and they put the reſt into the machine for making butter. Out of the milk of the evening before and of that morning, that was all put together after ſkimming, they took and put into the boiler 272 boccali, and they put under it two faggots of wood; which being burnt, were ſufficient to give the milk a warmth a little ſuperior to lukewarm. Then the boiler being withdrawn from the fire, the foreman put into it the runnet which they prepare in ſmall balls of one ounce each, turning the ball in his hand always kept in the milk entirely covered; and after it was perfectly diſſolved, he covered the boiler to keep the milk defended, that it might not ſuffer from the coldneſs of the ſeaſon, particularly as it was a windy day. I went then to look on the man that was making maſcarponies, &c. and then we went twice to examine if the milk was ſufficiently coagulated. At the 18 hours, according to the Italian clocks, or noon, the true manufactory of cheeſe began. The milk was coagulated in a manner to be taken from the boiler in pieces from the ſurface. The foreman, with a ſtick that had 18 points, or rather nine ſmall pieces of wood fixed by their

their middle in the end of it, and forming nine points on each ſide, began to break exactly all the coagulated milk, and did continue to do ſo for more than half an hour, from time to time examining it to ſee its ſtate. He ordered to renew the fire, and four faggots of willow branches were uſed all at once: he turned the boiler that the fire might act; and then the underman began to work in the milk with a ſtick, like the above, but only with four ſmall ſticks at the top, forming eight points, four at each ſide, a ſpan long each point. In a quarter of an hour the foreman mixed in the boiler the proper quantity of ſaffron, and the milk was all in knobs, and finer grained than before, by the effect of turning and breaking the coagulation, or curd, continually. Every moment the fire was renewed or fed; but with a faggot only at a time, to continue it regular. The milk was never heated much, nor does it hinder to keep the hand in it to know the fineneſs of the grain, which refines continually by the ſtick-work of the underman. It is of the greateſt conſequence to mind when the grain begins to take a conſiſtence. When it comes to this ſtate, the boiler is turned from the fire, and the underman immediately takes out the whey, putting it into proper receivers. In that manner the grain ſubſides to the bottom of the boiler; and leaving only in it whey enough to keep the grain covered a little, the foreman extending himſelf as much as he can over and in the boiler, unites with his hands the grained milk, making like a body of paſte of it. Then a large piece of linen is run by him under that paſte, while another man keeps the four corners of it, and the whey is directly put again into the boiler, by which is facilitated the means

Management of the Dairy.

Management of the Dairy.

of raiſing the paſte that is taken out of the boiler, and put for one quarter of an hour into the receiver where the whey was put before, in the ſame linen it was taken from the boiler; which boiler is turned again directly on the fire, to extract the maſcarpa (whey cheeſe), which is a ſecond product, eaten by poor people. After the paſte remained for a quarter of an hour in that receiver, it was taken out and turned into the wooden form called *faſſena*, without any thing elſe made than the rotundity, having neither top nor bottom. Immediately after having turned it into that round wooden form, they put a piece of wood like a cheeſe on it, putting and increaſing gradually weights on it, which ſerve to force out the remnant of the whey; and in the evening the cheeſe ſo formed is carried into the warehouſe, where, after 24 hours, they begin to give the ſalt. It remains in that warehouſe for 15 or 20 days; but in ſummer only from 8 to 12 days. Meanwhile the air and ſalt form the cruſt to it; and then it is carried into another warehouſe for a different ſervice. In the ſecond warehouſe they turn every day all the cheeſes that are not older than ſix months; and afterwards it is enough if they are only turned every 48 or 60 hours, keeping them clean, in particular, of that bloom which is inevitable to them, and which, if neglected, turns muſty, and cauſes the cheeſe to acquire a bad ſmell. The Lodeſan, becauſe it is a province watered, has a great deal of meadows, and abounds with cows, its product being moſtly in cheeſe, butter, &c. However, the province of Pavia makes a great deal of that cheeſe; and we, Milaneſe, do likewiſe the ſame from the ſide of Porte Toſa, Romana,

mana, Ticineſe, and Vercilino, becauſe we have fine meadows and dairy farms. Making of Fruit-Liquors.

SECT. IX.

MAKING OF FRUIT-LIQUORS.

As an object of curioſity to the public at large, and of agricultural value in certain Britiſh counties, we ſhall ſhortly notice theſe.

Cyder, as is well known, is made from apples, and *perry* from pears only. The general method of preparing both theſe liquors is very much the ſame; and a deſcription will be given of the way in which theſe fruits are gathered, ground, and preſſed. The mill is not eſſentially different from that of a common tanner's mill for grinding bark. It conſiſts of a mill-ſtone from two and a half to four feet and a half in diameter, running on its edge in a circular ſtone trough, from nine to twelve inches in thickneſs, and from one to two tons in weight. The bottom of the trough in which this ſtone runs is ſomewhat wider than the thickneſs of the ſtone itſelf; the inner ſide of the groove riſes perpendicularly, but the outer ſpreads in ſuch a manner as to make the top of the trough ſix or eight inches wider than the bottom; by which means there is room for the ſtone to run freely, and likewiſe for putting in the fruit, and ſtirring it up while grinding. The bed of a middle-ſized mill is about nine feet, ſome 10, and ſome 12; the whole being compoſed of two, three, or four ſtones cramped together and finiſhed Deſcription of a cyder mill and mill-houſe.

Making of Fruit-Liquors.

after being cramped in this manner. The beſt ſtones are found in the foreſt of Dean; generally a dark, reddiſh gritſtone, not calcareous; for if it were of a calcareous quality, the acid juice of the fruits would act upon it and ſpoil the liquor: a clean-grained grindſtone grit is the fitteſt for the purpoſe. The runner is moved by means of an axle paſſing through the centre, with a long arm reaching without the bed of the mill, for a horſe to draw by; on the other ſide is a ſhorter arm paſſing through the centre of the ſtone, as repreſented in the figure. An iron bolt, with a large head, paſſes through an eye, in the lower part of the ſwivel on which the ſtone turns, into the end of the inner arm of the axis; and thus the double motion of it is obtained, and the ſtone kept perfectly upright There ought alſo to be fixed on the inner arm of the axis, about a foot from the runner, a cogged wheel working in a circle of cogs, fixed upon the bed of the mill. The uſe of theſe is to prevent the runner from ſliding, which it is apt to do, when the mill is full; it likewiſe makes the work more eaſy for the horſe. Theſe wheels ought to be made with great exactneſs. Mr Marſhal obſerves, that it is an error to make the horſe draw by traces: "The acting point of draught (ſays he), the horſe's ſhoulder, ought, for various reaſons, to be applied immediately at the end of the arm of the axis; not two or three yards before it; perhaps of a ſmall mill near one-fourth of its circumference." The building in which the mill is encloſed ought to be of ſuch a ſize, that the horſe may have a path of three feet wide betwixt the mill and the walls; ſo that a middling-ſized mill, with its horſe-path, takes up a ſpace of 14 or 15 feet every way. The whole dimenſions of the mill-houſe, according

ing to our author, to render it any way convenient, are 24 feet by 20: it ought to have a floor thrown over it at the height of ſeven feet; with a door in the middle of the front, and a window oppoſite, with the mill on one ſide, and the preſs on the other ſide of the window. The latter muſt be as near the mill as convenience will allow, for the more eaſy conveying the ground fruit from the one to the other. The preſs, which is of a very ſimple conſtruction, has its bed or bottom about five feet ſquare. This ought to be made entirely either of wood or ſtone; the practice of covering it with lead being now univerſally known to be pernicious. It has a channel cut a few inches within its outer edge, to catch the liquor as it is expreſſed, and convey it to a lip formed by a projection on that ſide of the bed oppoſite to the mill; having under it a ſtone trough or wooden veſſel, ſunk within the ground, when the bed is fixed low, to receive it. The preſs is worked with levers of different lengths; firſt a ſhort, and then a moderately long one, both worked by hand; and laſtly, a bar eight or nine feet long, worked by a capſtan or windlaſs. The expence of fitting up a mill-houſe is not very great. Mr Marſhal computes it from 20l. to 25l.; and, on a ſmall ſcale, from 10l. to 15l. though much depends on the diſtance and carriage of the ſtone. When once fitted up, it will laſt many years. Making of Fruit-Liquors.

The making of the fruit-liquors under conſideration requires an attention to the following particulars: I. The fruit. II. The grinding. III. Preſſing. IV. Fermenting. V. Correcting. VI. Laying up. VII. Bottling. Each of which heads is ſubdivided into ſeveral others.

Making of Fruit-Liquors.

I. In the *management of the fruit*, the following particulars are to be conſidered.

Management of the fruit.

1. The time of gathering; which varies according to the nature of the fruit. The early pears are fit for the mill in September; but few apples are ready for gathering before Michaelmas; though, by reaſon of accidental circumſtances, they are frequently manufactured before that time. For ſale cyder, and keeping drink, they are ſuffered to hang upon the trees till fully ripe: and the middle of October is generally looked upon to be a proper time for gathering the ſtire-apple. The criterion of a due degree of ripeneſs is the fruit falling from the tree: and to force it away before that time, in Mr Marſhal's opinion, is robbing it of ſome of its moſt valuable particles. "The harveſting of fruit (ſays he) is widely different in this reſpect from the harveſting of grain; which has the entire plant to feed it after its ſeparation from the ſoil; while fruit, after it is ſevered from the tree, is cut off from all poſſibility of a further ſupply of nouriſhment; and although it may have reached its wonted ſize, ſome of its more eſſential particles are undoubtedly left behind in the tree." Sometimes, however, the fruits which are late in ripening are apt to hang on the tree until ſpoiled by froſts; though weak watery fruits ſeem to be moſt injured in this manner; and Mr Marſhal relates an inſtance of very fine liquor being made from golden pippins, after the fruit had been frozen as hard as ice.

Method of gathering it.

2. The method of gathering. This, as generally practiſed, is directly contrary to the principle laid down by Mr Marſhal, viz. beating them down with long ſlender poles. An evident diſadvantage of this method is, that the fruit is of unequal ripeneſs; for the apples

on

on the ſame trees will differ many days, perhaps even weeks, in their time of coming to perfection; whence ſome part of the richneſs and flavour of the fruit will be effectually and irremediably cut off. Nor is this the only evil to be dreaded; for, as every thing depends on the fermentation it has to undergo, if this be interrupted, or rendered complex by a mixture of ripe and unripe fruits, and the liquor be not in the firſt inſtance ſufficiently purged from its feculencies, it is difficult to clear the liquor afterwards. The former defect the cyder-makers attempt to remedy by a mixture of brown ſugar and brandy, and the latter by bullocks blood and brimſtone; but neither of theſe can be expected to anſwer the purpoſe very effectually. The beſt method of avoiding the inconveniences ariſing from an unequal ripening of the fruit, is to go over the trees twice, once with a hook, when the fruit begins to fall ſpontaneouſly; the ſecond time, when the latter are ſufficiently ripened, or when the winter is likely to ſet in, when the trees are to be cleared with the poles above mentioned. Making of Fruit-Liquors.

3. Maturing the gathered fruit. This is uſually done by making it into heaps; but Mr Marſhal entirely diſapproves of the practice; becauſe, when the whole are laid in a heap together, the ripeſt fruit will begin to rot before the other has arrived at that degree of artificial ripeneſs which it is capable of acquiring. "The due degree of maturation of fruit for liquors (he obſerves) is a ſubject about which men differ much in their ideas. The prevailing practice of gathering into heaps until the ripeſt begin to rot, is waſting the beſt of the fruit, and is by no means an accurate criterion. Some ſhake the fruit, and judge by the rattling Maturing it, &c.

Making of Fruit-Liquors.

of the kernels; others cut through the middle, and judge by their blackneſs; but none of theſe appears to be a proper teſt. It is not the ſtate of the kernels but of the fleſh, not of a few individuals, but of the greater part of the prime fruit, which renders the collective body fit or unfit to be ſent to the mill. The moſt rational teſt of the ripeneſs of the fruit, is that of the fleſh having acquired ſuch a degree of mellowneſs, and its texture ſuch a degree of tenderneſs, as to yield to moderate preſſure. Thus, when the knuckle at the end of the tumb can, with moderate exertion, be forced into the pulp of the fruit, it is deemed in a fit ſtate for grinding."

4. Preparation for the mill. The proper management of the fruit is to keep the ripe and unripe fruit ſeparate from each other: but this cannot be done without a conſiderable degree of labour; for as by numberleſs accidents the ripe and unripe fruits are frequently confounded together, there cannot be any effectual method of ſeparating them except by hand; and Mr Marſhal is of opinion, that this is one of the grand ſecrets of cyder making, peculiar to thoſe who excel in the buſineſs; and he is ſurpriſed that it ſhould not before this time have come into common practice.

5. Mixing fruits for liquor. Our author ſeems to doubt the propriety of this practice; and informs us, that the finer liquors are made from ſelect fruits; and he hints that it might be more prope to mix liquors after they are made, than to put together the crude fruits.

II. *Grinding*, and management of the fruit when ground.

Making of Fruit-Liquors. Grinding.

1. For the greater convenience of putting the fruit into the mill, every mill-houſe ſhould have a fruit-chamber over it, with a trap-door to lower the fruit down into the mill. The beſt manner in which this can be accompliſhed, is to have the valve over the bed of the mill, and furniſhed with a cloth ſpout or tunnel reaching down to the trough in which the ſtone moves. No ſtraw is uſed in the lofts; but ſometimes the fruit is turned. In Herefordſhire, it is generally believed, that grinding the rind and ſeeds of the fruit, as well as the fleſhy part of the pulp, is neceſſary towards the perfection of the cyder; whence it is neceſſary, that every kind of pains ſhould be taken to perform the grinding in the moſt perfect manner. Mr Marſhal complains, that the cyder-mills are ſo imperfectly finiſhed by the workmen, that for the firſt *fifty years* they cannot perform their work in a proper manner. Inſtead of being nicely fitted to one another with the ſquare and chiſel, they are hewn over with a rough tool in ſuch a careleſs manner, that horſe-beans might lie in ſafety in their cavities. Some even imagine this to be an advantage, as if the fruit was more effectually and completely broken by rough than ſmooth ſtones. Some uſe fluted rollers of iron; but theſe will be corroded by the juice, and thus the liquor might be tinged. Smooth rollers will not lay hold of the fruit ſufficiently to force it through.

Another improvement requiſite in the cyder-mills is to prevent the matter in the trough from riſing before the ſtone in the laſt ſtage of grinding, and a method of ſtirring it up in the trough more effectually than can be done at preſent. To remedy the former of theſe defects, it might perhaps be proper to grind the fruit

Making of Fruit-Liquors.

fruit firſt in the mill to a certain degree; and then put it between two ſmooth rollers to finiſh the operation in the moſt perfect manner. It is an error to grind too much at once; as this clogs up the mill, and prevents it from going eaſily. The uſual quantity for a middle ſized mill is a bag containing four corn buſhels; but our author had once an opportunity of ſeeing a mill in which only half a bag was put; and thus the work ſeemed to go on more eaſily, as well as more quickly, than when more was put in at once. The quantity put in at one time is to be taken out when ground. The uſual quantity of fruit ground in a day is as much as will make three hogſheads of perry, or two of cyder.

2. Management of the ground fruit. Here Mr Marſhal condemns in very ſtrong terms the practice of preſſing the pulp of the fruit as ſoon as the grinding is finiſhed; becauſe thus neither the rind nor ſeeds have time to communicate their virtues to the liquor. In order to extract theſe virtues in the moſt proper manner, ſome allow the ground fruit to lie 24 hours or more after grinding, and even regrind it, in order to have in the moſt perfect manner the flavour and virtues of the ſeeds and rind.

Preſſing, &c.

III. *Preſſing the fruit*, and management of the *reſiduum*. This is done by folding up the ground fruit in pieces of hair-cloth, and piling them up above one another in a ſquare frame or mould; and then pulling down the preſs upon them, which ſqueezes out the juice, and forms the matter into thin and almoſt dry cakes. The firſt runnings come off foul and muddy; but the laſt, eſpecially in perry, will be as clear and fine as if filtered through paper. It is common to throw

throw away the reſiduum as uſeleſs; ſometimes it is made uſe of when dry as fuel; ſometimes the pigs will eat it, eſpecially when not thoroughly ſqueezed; and ſometimes it is ground a ſecond time with water, and ſqueezed for an inferior kind of liquor uſed for the family. Mr Marſhal adviſes to continue the preſſure as long as a drop can be drawn. "It is found (ſays he), that even by breaking the cakes of refuſe with the hands only gives the preſs freſh power over it; for though it has been preſſed to the laſt drop, a gallon or more of additional liquor may be got by this means. Regrinding them has a ſtill greater effect: In this ſtate of the materials the mill gains a degree of power over the more rigid parts of the fruits, which in the firſt grinding it could not reach. If the face of the runner and the bottom of the trough were dreſſed with a broad chiſel, and made true to each other, and a moderate quantity of reſiduum ground at once, ſcarcely a kernel could eſcape unbroken, or a drop of liquor remain undrawn." Making of Fruit-Liquors.

But though the whole virtue of the fruit cannot be extracted without grinding it very fine, ſome inconvenience attends this practice, as part of the pulp thus gets through the haircloth, and may perhaps be injurious to the ſubſequent fermentation. This, however, may be, in a great meaſure, remedied by ſtraining the firſt runnings through a ſieve. The whole ſhould alſo be allowed to ſettle in a caſk, and drawn off into a freſh veſſel, previous to the commencement of the fermentation. The reduced fruit ought to remain ſome time between the grinding and preſſing, that the liquor may have an opportunity of forming an extract with the rind and kernels: but this muſt not be puſhed too far,

Making of Fruit-Liquors.

far, as in this caſe the colour of the cyder would be hurt; and the moſt judicious managers object to the pulp remaining longer than 12 hours without preſſure. "Hence (ſays our author), upon the whole, the moſt eligible management in this ſtage of the art appears to be this: Grind one preſsful a-day; preſs and regrind the reſiduum in the evening; infuſe the reduced matter all night among part of the firſt runnings; and, in the morning, repreſs while the next preſsful is grinding.

Fermentation.

IV. *Fermentation.* The common practice is to have the liquor turned; that is, put into caſks or hogſheads immediately from the preſs, and ſo fill them quite full: but it is undoubtedly more proper to leave ſome ſpace empty to be filled up afterwards. No accurate experiment has been made with regard to the temperature of the air proper to be kept up in the place where the fermentation goes on. Froſt is prejudicial: but when the proceſs uſually commences, that is, about the middle of October, the liquor is put into airy ſheds, where the warmth is ſcarce greater than in the open atmoſphere; nay, the caſks are frequently expoſed to the open air, without any covering farther than a piece of tile or flat ſtone over the bunghole, propped up by a wooden pin on one ſide to cauſe the rain water to run off.

In making of fruit-liquors, no ferment is uſed as in making of beer; though, from Mr Marſhal's account of the matter, it ſeems far from being unneceſſary. Owing to this omiſſion, the time of the commencement of the fermentation is entirely uncertain. It takes place ſometimes in one, two, or three days; ſometimes not till a week or month after turning: but it has been obſerved,

obſerved, that liquor which has been agitated in a carriage, though taken immediately from the preſs, will ſometimes paſs almoſt immediately into a ſtate of fermentation. The continuance of the fermentation is no leſs uncertain than the commencement of it. Liquors when much agitated, will go through it perhaps in one day; but when allowed to remain at reſt, the fermentation commonly goes on two or three days, and ſometimes five or ſix. The fermenting liquor, however, puts on a different appearance according to circumſtances. When produced from fruits improperly matured, it generally throws up a thick ſcum reſembling that of malt liquor, and of a thickneſs proportioned to the ſpecies and ripeneſs of the fruit; the riper the fruit, the more ſcum being thrown up. Perry gives but little ſcum, and cyder will ſometimes alſo do the ſame; ſometimes it is intentionally prevented from doing it. Making of Fruit-Liquors.

After having remained ſome time in the fermenting veſſel, the liquor is racked or drawn off from the lees and put into freſh caſks. In this part of the operation alſo Mr Marſhal complains greatly of the little attention that is paid to the liquor. The ordinary time for racking perry is before it has done hiſſing, or ſometimes when it begins to emit fixed air in plenty. The only intention of the operation is to free the liquor from its fæces by a cock placed at a little diſtance from the bottom; after which the remainder is to be filtered through a canvas or flannel bag. This filtered liquor differs from the reſt in having a higher colour; having no longer any tendency to ferment, but, on the contrary, checking the fermentation of that which is racked off; and if it loſes its brightneſs, it is no longer

eaſily

Making of Fruit-Liquors.

eaſily recovered. A freſh fermentation uſually commences after racking; and if it become violent, a freſh racking is neceſſary in order to check it; in conſequence of which the ſame liquor will perhaps be racked five or ſix times. But if only a ſmall degree of fermentation takes place, which is called *fretting*, it is allowed to remain in the ſame caſk; though even here the degree of fermentation which requires racking is by no means determined. Mr Marſhal informs us, that the beſt manufacturers, however, repeat the rackings until the liquor will lie quiet, or nearly ſo; and if it be found impracticable to accompliſh this by the ordinary method of fermentation, recourſe muſt be had to fumigation with ſulphur, which is called *ſtumming* the caſks. For this fumigation it is neceſſary to have matches made of thick linen cloth, about ten inches long, and an inch broad, thickly coated with brimſtone for about eight inches of their length. The caſk is then properly ſeaſoned, and every vent, except the bunghole, tightly ſtopped; a match is kindled, lowered down into the caſk, and held by the end undipped until it be well lighted, and the bung be driven in; thus ſuſpending the lighted match within the caſks. Having burnt as long as the contained air will ſupply the fire, the match dies, the bung is raiſed, the remnant of the match drawn out, and the caſk ſuffered to remain before the liquor be put into it for two or three hours, more or leſs according to the degree of power the ſulphur ought to have. The liquor retains a ſmell of the ſulphureous acid; but this goes off in a ſhort time, and no bad effect is ever obſerved to follow.

In ſome places the liquor is left to ferment in open caſks, where it ſtands till the firſt fermentation be pret-

ty

ty well over; after which the froth or yeaſt collected upon the ſurface is taken off, it being ſuppoſed that it is this yeaſt mixing with the clear liquor which cauſes it to fret after racking. The fermentation being totally ceaſed, and the lees ſubſided, the liquor is racked off into a freſh caſk, and the lees filtered as above directed. Our author mentions a way of fermenting fruit-liquors in broad ſhallow vats, not leſs than five feet in diameter, and little more than two feet deep; each vat containing about two hogſheads. In theſe the liquor remains until it has done riſing, or till the fermentation has nearly ceaſed, when it is racked off without ſkimming, the critical juncture being caught before the yeaſt fall; the whole ſinking gradually together as the liquor is drawn off. In this practice alſo the liquor is ſeldom drawn off a ſecond time. Making of Fruit-Liquors.

Cyder is made of three different kinds, viz. *rough*, *ſweet*, and *of a middle richneſs*. The firſt kind being uſually deſtined for ſervants, is made with very little ceremony. "If it is but *zeyder* (ſays Mr Marſhal), and has body enough to keep, no matter for the richneſs and flavour. The rougher it is, the further it will go, and the more acceptable cuſtom has rendered it not only to the workmen but to their maſters. A palate accuſtomed to ſweet cyder would judge the rough cyder of the farm-houſes to be a mixture of vinegar and water, with a little diſſolved alum to give it roughneſs." The method of producing this auſtere liquor is to grind the fruits in a crude under-ripe ſtate, and ſubject the liquor to a full fermentation.—For the ſweet liquor, make choice of the ſweeter fruits; mature them fully; and check the fermentation of the liquor.—To produce liquors of a middle richneſs, the nature of the fruit, as Different kinds of cyder.

well

Making of Fruit-Liquors.

well as the ſeaſon in which it is matured, muſt be conſidered. The fruits to be made choice of are ſuch as yield juices capable of affording a ſufficiency both of richneſs and ſtrength; though much depends upon proper management. Open vats, in our author's opinion, are preferable to cloſe veſſels.

V. *Correcting*, provincially called *doctoring*. The imperfections which art attempts to ſupply in theſe liquors are, 1. Want of ſtrength; 2. Want of richneſs; 3. Want of flavour; 4. Want of colour and brightneſs.

Of correcting or doctoring the liquors.

The want of ſtrength is ſupplied by brandy or any other ſpirit, in ſufficient quantity to prevent the acetous fermentation. The want of richneſs is ſupplied by what are generally termed *ſweets*, but prepared in a manner, which our author ſays, has never fallen under his notice. To ſupply the want of flavour, an infuſion of hops is ſometimes added, which is ſaid to communicate an agreeable bitter, and at the ſame time a fragrance; whence it becomes a ſubſtitute for the juices of the rind and kernels thrown away to the pigs and poultry, or otherwiſe waſted. The want of colour is ſometimes ſupplied by elder berries, but generally by burnt ſugar, which gives the deſired colour, and a degree of bitter which is very much liked. The ſugar is prepared either by burning it on a ſalamander, and ſuffering it to drop, as it melts, into water; or by boiling it over the fire (in which caſe brown ſugar is to be uſed), until it acquire an agreeable bitter; then pouring in boiling water in the proportion of a gallon to two pounds of ſugar, and ſtir until the liquor become uniform. A pint of this preparation will colour a hogſhead of cyder. Brightneſs is obtained by a mixture of

the

the blood of bullocks or ſheep; that of ſwine being rejected, though it does not appear to be more unfit for the purpoſe than either of the other two. The only thing neceſſary to be done here is to ſtir the blood well as it is drawn from the animal, to prevent the parts from ſeparating; and it ought to be ſtirred "both ways, for a quarter of an hour." The liquor, however, is not always in a proper condition for being refined with this ingredient: on which account a little of it ought frequently to be tried in a vial. A quart or leſs will be ſufficient for a hogſhead. After the blood is poured in, the liquor ſhould be violently agitated, to mix the whole intimately together. This is done by a ſtick ſlit into four, and inſerted into the bunghole; working it briſkly about in the liquor until the whole be thoroughly mixed. In about 24 hours the blood will be ſubſided, and the liquor ought inſtantly to be racked off; as by remaining upon the blood even for two or three days, it will receive a taint not eaſily to be got rid of. It is remarkable, that this refinement with the blood carries down not only the fæces, but the colour alſo; rendering the liquor, though ever ſo highly coloured before, almoſt as limpid as water. Iſinglaſs and eggs are ſometimes made uſe of in fining cyder as well as wine. Making of Fruit-Liquors.

VI. The *laying up* or ſhutting up the cyder in cloſe caſks, according to Mr Marſhal, is as little underſtood as any of the reſt of the parts; the bungs being commonly put in at ſome certain time, or in ſome particular month, without any regard to the ſtate the liquor itſelf is in. "The only criterion (ſays he) I have met with for judging the critical time of laying up, is when a fine white cream-like matter firſt begins Of laying up, or caſking.

Making of Fruit-Liquors.

to form upon the ſurface. But this may be too late; it is probably a ſymptom, at leaſt, of the acetous fermentation, which, if it take place in any degree, muſt be injurious. Yet if the caſks be bunged right, ſome criterion is neceſſary; otherwiſe, if the vinous fermentation have not yet finally ceaſed, or ſhould recommence, the caſks will be endangered, and the liquor injured. Hence, in the practice of the moſt cautious manager whoſe practice I have had an opportunity of obſerving, the bungs are firſt driven in lightly, when the liquor is fine, and the vinous fermentation is judged to be over; and, ſome time afterward, when all danger is paſt, to fill up the caſks, and drive the bungs ſecurely with a rag, and roſin them over at top." Moſt farmers are of opinion, that after the liquor is done fermenting, it ought to have ſomething to *feed upon*; that is, to prevent it from running into the acetous fermentation. For this purpoſe ſome put in parched beans, others egg-ſhells, ſome mutton ſuet, &c. Mr Marſhal does not doubt, that ſomething may be uſeful; and thinks that iſinglaſs may be as proper as any thing that can be got.

Bottling.

VII. *Bottling*. This depends greatly on the quality of the liquors themſelves. Good cyder can ſeldom be bottled with propriety under a year old; ſometimes not till two. The proper time is, when it has acquired the utmoſt degree of richneſs and flavour in the caſks; and this it will preſerve for many years in bottles. It ought to be quite fine at the time of bottling; or if not ſo naturally, ought to be fined artificially with iſinglaſs and eggs.

Of cyderkin.

The liquor, called *cyderkin*, *purre*, or *perkin*, is made of the murk or groſs matter remaining after the cyder

is

is preſſed out. To make this liquor, the murk is put into a large vat, with a proper quantity of boiled water, which has ſtood till it be cold again: if half the quantity of water be uſed that there was of cyder, it will be good; if the quantities be equal, the cyderkin will be ſmall. The whole is left to infuſe 48 hours, and then well preſſed; what is ſqueezed out by the preſs is immediately tunned up and ſtopped; it is fit to drink in a few days. It clariſies of itſelf, and ſerves in families inſtead of ſmall beer. It will keep, if boiled, after preſſure, with a convenient quantity of hops. Making of Fruit-Liquors.

We muſt not conclude this ſection without particular notice of the liquor called *cyder wine*, which is made from the juice of apples taken from the preſs and *boiled*, and which being kept three or four years is ſaid to reſemble Rheniſh. The method of preparing this wine, as communicated by Dr Ruſh of America, where it is much practiſed, conſiſts in evaporating, in a brewing copper, the freſh apple-juice till half of it be conſumed. The remainder is then immediately conveyed into a wooden cooler, and afterwards is put into a proper caſk, with an addition of yeaſt, and fermented in the ordinary way. The proceſs is evidently borrowed from what has long been practiſed on the recent juice of the grape, under the term of *vin cuit*, or boiled wine, not only in Italy, but alſo in the iſlands of the Archipelago, from time immemorial. Of cyder wine, according to Dr Ruſh's recipe.

This proceſs has lately become an object of imitation in the cyder counties, and particularly in the weſt of England, where it is reported that many hundred hogſheads of this wine have already been made: and as it is ſaid to betray no ſign of an impregnation of copper

Fences. by the uſual chemical teſts, it is conſidered as perfectly wholeſome, and is accordingly drunk without apprehenſion by the common people. Others, however, ſuſpect its innocence; whence it appeared an object of no ſmall moment to determine, in ſo doubtful a matter, whether or not the liquor acquires any noxious quality from the copper in which it is boiled. With this view Dr Fothergill * made a variety of experiments; and the reſult ſeemed to afford a ſtrong preſumption that the cyder wine *does* contain a minute impregnation of copper; not very conſiderable indeed, but yet ſufficient, in the doctor's opinion, to put the public on their guard concerning a liquor that comes in ſo very "queſtionable a ſhape."

SECT. X.

OF FENCES.

Kinds of fences enumerated. We ſhall conclude the preſent treatiſe by taking notice of the various kinds of fences that may be found valuable in agriculture.—Robert Somerville, Eſq. of Haddington, in a communication to the Board of Agriculture, has endeavoured to enumerate the whole ſimple and compound fences that are at preſent uſed. *Simple fences* are thoſe that conſiſt of one kind only, as a ditch, a hedge, or a wall.—*Compound fences* are made by the union of two or more of theſe; as a hedge and ditch, or hedge

* *Bath Papers*, vol. v. p. 339.

hedge and wall. The following is the liſt which he has given of them: Fences.

"*Simple Fences.*

I. Simple ditch, with a bank on one ſide.
II. Double ditch, with a bank of earth between.
III. Bank of earth, with a perpendicular facing of ſod.
IV. Ha-ha, or ſunk fence.
V. Palings, or *timber fences*, of different kinds, viz.
1. Simple nailed paling of rough timber.
2. Jointed horizontal paling.
3. Upright lath paling.
4. Horizontal paling of young firs.
5. Upright ditto of do.
6. Chain fence.
7. Net fence.
8. Rope fence.
9. Flake or hurdle fence.
10. Ozier or willow fence.
11. Fence of growing poſts.
12. Shingle fence, horizontal.
13. Ditto upright.
14. Warped paling.
15. Open paling, warped with dead thorns or branches of trees.
VI. Dead hedges, various kinds.
VII. Live hedges.
VIII. Walls.
1. Dry ſtone wall, coped and uncoped.
2. Stone and lime ditto, do.
3. Stone and clay, do.
4. Stone and clay harled, or daſhed with lime.
5. Dry ſtone ditto, lipped with lime.

Fences. 6. Dry ſtone, ditto, lipped and harled.
7. Dry ſtone, pinned and harled.
8. Brick walls.
9. Framed walls.
10. Galloway dike or wall.
11. Turf wall.
12. Turf and ſtone, in alternate layers.
13. Mud walls, with ſtraw.

" *Compound Fences.*

1. Hedge and ditch, with or without paling.
2. Double ditto.
3. Hedge and bank, with or without paling.
4. Hedge in the face of a bank.
5. Hedge on the top of a bank.
6. Devonſhire fence.
7. Hedge, with ſingle or double paling.
8. Hedge and dead hedge.
9. Hedge and wall.
10. Hedge, ditch, and wall.
11. Hedge in the middle of a wall.
12. Hedge and ditch, with a row of trees.
13. Hedge, or hedge and wall, with belt of planting.
14. Hedge, with the corners planted.
15. Reed fence, or port and rail, covered with reeds."

Of the nature of each of theſe, and the advantages attending the uſe of them, we ſhall take ſome ſhort notice. The ditch, which is one of the ſimple fences, is moſt frequently conſidered merely as an open drain intended to relieve the ſoil of ſuperfluous moiſture. It is frequently alſo, however, made uſe of without any ſuch intention, as a fence for the confinement of cattle; but

Ditches.

but it is more frequently uſed with the double view of ſerving as a fence, and as a drain. It is made in a variety of ways, according to the object in view. If a ditch is meant to be uſed merely as a drain, the earth thrown out of it ought by no means to be formed into a bank upon the ſide of it, becauſe ſuch a practice, as formerly ſtated, when treating of draining, has a tendency to injure its utility by cutting off its communication with one ſide of the field to be drained; but when a ditch is intended to be uſed as a fence, a different rule of proceeding muſt be followed. In that caſe, the object in view will be greatly forwarded by forming the earth taken out of the ditch into a bank upon its ſide, which, when added to the depth of the ditch, will form a barrier of conſiderable value. Fences.

Ditches are ſometimes formed of an uniform breadth at top and bottom. This kind of ditch is liable to many objections. After froſts and rains, its ſides are perpetually crumbling down and falling in; and if the field in which ſuch a ditch is placed have a conſiderable declivity, the bottom of the ditch will be extremely liable to be undermined by any current of water, that either permanently or caſually takes place in it; at the ſame time, ſuch ditches have been found very uſeful in low-lying clay or carſe ſoils where the country is level. From the nature of the ſoil, the ſides of the ditches in ſuch ſituations are tolerably durable. No rapid current of water can exiſt to undermine them; and, by their figure, they withdraw from the plough the ſmalleſt poſſible portion of ſurface. Single Ditches.

Other ditches are conſtructed wide above, with a gradual ſlope from both ſides downwards. This form of a ditch is in general the beſt, where it is at all to be

Fences. uſed for the drainage of the field, as the ſides are not ſo liable as in the former caſe to be excavated by the current of water. Hence it is more durable, and by diminiſhing the quantity of digging at the bottom, it is more eaſily executed.

A third kind of ditches are ſo formed as to have one ſide ſloping, and the other perpendicular. This kind of ditch partakes of the whole perfections and imperfections of the two former. It is extremely uſeful, however, in fields of which ſheep form a part of the ſtock, and where the bottom of the ditch contains a current of water; for, in ſuch caſes, when ſheep tumble into a deep ditch, whoſe ſides are pretty ſteep, they are very apt to periſh; but by making one ſide of the ditch very much ſloped, while the other approaches to the perpendicular, they are enabled to make their eſcape; while at the ſame time, by the bed of the ſtream being widened, the perpendicular ſide of the ditch is leſs liable to be undermined. When the earth taken out of a ditch is formed into a bank on one ſide, a projecting vacant ſpace of ſix or eight inches ought always to be left between the bank and the ditch, to prevent the earth from tumbling in and filling up the ditch.

Double ditches. A double ditch, with a bank of earth between the two, formed out of the earth obtained by digging them, has many obvious advantages over the ſingle ditch, when conſidered as a fence; for the earth taken out of the two ditches, when properly laid up in the middle, will naturally become a very formidable rampart, which cattle will not readily attempt to croſs. It is alſo excellently adapted for the purpoſe of open drainage, and it ought always to be uſed upon the ſides of highways, where

where the adjoining lands have a conſiderable declivity towards the road. In ſuch caſes, the inner ditch receives the water from the field, and prevents it from waſhing down or overflowing the road in the time of heavy rains; an inconvenience which frequently cannot otherwiſe be avoided. Fences.

The bank of earth, with a perpendicular facing of ſod, and a ſlope behind, is uſeful in ſome ſituations, as in making folds for the confinement of ſheep or cattle, in which caſe the front or perpendicular ſide of the bank muſt be turned inwards. It is alſo valuable on the ſides of highways to protect the adjoining fields, and alſo for fencing belts of planting, or encloſing ſtack-yards and cottages. The front of the bank is made with the turfs taken from the ſurface of the ſloping ditch, and the mound at the back with the earth taken out of it. This fence, when well executed, is ſaid to laſt a conſiderable time. Bank of earth.

The ha-ha, or ſunk fence, very nearly reſembles the mound of earth with the perpendicular facing of turf, with this difference, that the facing of the ha-ha is of ſtone. The height of both depends almoſt entirely upon the depth of the ditch; both of them in truth conſiſt of the kind of ditch already mentioned, of which the one ſide ſlopes while the other is perpendicular, and differ from it chiefly in this reſpect, that the perpendicular ſide is faced with turf or ſtone. The ſtone-facing is made either of dry ſtone, or of ſtone and lime. In the Agricultural Report of Cromarty, the mode of making the ſunk fence is thus deſcribed: "Upon the line where this fence is intended, begin to ſink your ditch, taking the earth from as far as eight feet outward, and throwing it up on the inſide of the lines. The ha-ha, or ſunk fence.

This

Fences. This ditch and bank is not made quite perpendicular, but inclining inward towards the field as it riſes; to this is built a facing of dry ſtone, four feet and a half in height, one foot and three quarters broad at bottom, and one foot at top, over which a coping of turf is laid: the ditch or ſunk part forms an excellent drain. The whole of this is performed, when the ſtone, (we ſhall ſuppoſe) can be procured at a quarter of a mile's diſtance, for 6d. per yard." The principal defect of the ſunk fence conſiſts in this, that unleſs the bank at the back of it is conſiderably ſteep, or has a railing at the top, it forms a kind of ſnare on that ſide for cattle, as they muſt always be apt to tumble over it in dark nights.

Palings. Palings or timber fences are, in many places, much uſed, though they never can be conſidered with propriety as forming permanent encloſures. Of whatever materials they are formed their decay commences from the inſtant they are erected. This decay begins with the part of the paling that is put into the ground, which is ſpeedily rotted by the moiſture, or conſumed by worms or other animals that attack it. To guard as much as poſſible againſt this cauſe of decay, various devices have been adopted. It is a very general practice to burn the ſurface of that part of the ſtandards of the paling which is meant to be driven into the earth. It is alſo cuſtomary to cover the ſame part of the wood with a ſtrong coat of coarſe oil paint, and Lord Dundonald's coal varniſh has been recommended with this view. The points of the ſtandards that are to be fixed in the earth, ought to be dipped in the varniſh while it is boiling hot. Common tar or melted pitch have alſo been uſed with tolerable ſucceſs to defend the extremities of the ſtandards of paling. In ſome caſes,

where

where the expence could be afforded, large ſtones have been ſunk into the earth, with holes cut into them of a ſize adapted to receive the ends of the poſts of the paling. The durability of the wood in this caſe is greater, but it bears no proportion to the additional expence incurred. When poſts for paling can be obtained conſiſting of branches of trees, with the bark ſtill upon them, this natural covering enables them to remain uncorrupted for a longer period than can be accompliſhed by any artificial coating. It is no objection to this, that a part of the uncovered wood, or the bottom of the ſtake or poſt muſt be inſerted in the earth; for it is not at the bottom the ſtakes or poſts begin to decay, but at the uppermoſt place at which the earth touches them, or between the wet and the dry as it is called. Of the kinds of paling it is unneceſſary to ſay much. Fences.

The ſimple nailed paling of rough timber, conſiſts of poſts or ſtakes inſerted in the earth, and croſſed with three, four, or more horizontal bars or ſlabs, as they are called in Scotland. It is the moſt common of all, and is uſed to protect young hedges, or to ſtrengthen ditches when uſed as fences.

The jointed horizontal paling conſiſts of maſſy ſquare poles driven into the earth, and having openings cut into them for the reception of the extremities of the horizontal bars. Theſe openings, however, weaken the poles much, and cauſe them ſoon to decay; but this kind of paling has a very handſome and ſubſtantial appearance.

The upright lath paling is formed by driving ſtrong piles of wood into the earth, and croſſing theſe at top and bottom, with horizontal pieces of ſimilar ſtrength.

Upon

Fences. Upon theſe laſt are nailed, at every 6 or 12 inches diſtance, laths or pieces of ſawn wood, of the ſhape and ſize of the laths uſed for the roofs of tiled houſes. This kind of paling prevents cattle from putting their heads through to crop or injure young hedges or trees.

The horizontal paling of firs or the weedings of other young trees, does not differ from the palings already deſcribed, unleſs in this reſpect, that the materials of which it is formed, conſiſt not of timber cut down for the purpoſe, but of the thinnings of woods or belts of planting. Such palings are uſually more formidable to cattle than any other, becauſe, when the lateral twigs that grow out of large branches are lopped off in a coarſe manner, the branch ſtill retains a roughneſs which keeps cattle at a diſtance.

Chain fence. The chain horizontal fence is made by fixing ſtrong piles of wood in the earth in the direction in which the fence is to run, and fixing three chains at regular diſtances, extending horizontally from pile to pile, inſtead of croſs bars of wood. Inſtead of poſts of wood, pillars of maſon work are ſometimes uſed, and between theſe the chains are extended. A chain fence will confine horſes or cattle, but is unfit to confine ſheep or hogs. From its expenſive nature, it can only be uſed in public walks, or for ſtretching acroſs ſtreams or pieces of water, where the encloſure can be completed in no other way.

The net fence is uſed for pleaſure ground, and inſtead of chains, as in the former caſe, it conſiſts of a ſtrong net extended between upright piles. Such a fence may be a very pretty ornament, but could be of little uſe againſt the horns of cattle.

The rope fence is conſtructed like the chain fence,

and

and differs from it only in the uſe of cords inſtead of metal chains, and has the ſame defect of being uſeleſs againſt ſwine and ſheep. Fences.

The moveable wooden fence, or flake or hurdle fence, conſiſts of a kind of moveable paling, uſed for confining ſheep or cattle to a certain ſpot when feeding upon a turnip field; and, in this view, it is extremely uſeful: for if the cattle were allowed to range at large over the field, a great quantity of the turnips would be deſtroyed by having pieces eaten from them, which would immediately ſpoil and rot before the remainder could be conſumed; whereas, by the uſe of thoſe moveable palings, the ſheep or cattle having only a certain quantity of food allotted to them at a time, are compelled to eat it clean up without any loſs. Hurdle fence.

The oſier or willow fence, or wattled fence, is made by driving, in the direction of the fence, ſtakes of willow or poplar, of half the thickneſs of a man's wriſt, into the earth, about 18 inches aſunder. They are then bound together with ſmall twigs of the willows or poplars twiſted and interwoven with them. If the upright ſtakes have been recently cut down, and if the fence is made about the end of autumn, they will take root and grow in the ſpring. If their new lateral branches are afterwards properly interwoven and twiſted together, they will become in two or three years a permanent and almoſt impenetrable fence. Live fences.

The paling of growing trees, or rails nailed to growing poſts, is formed by planting beech, larch, or other trees, at the diſtance of a yard from each other, in the direction in which the fence is wanted. When 10 or 12 feet high, they muſt be cut down to 6 feet. The cutting of the tops will make them puſh out a great

Fences. number of lateral branches, which may be interwoven with the upright part of the tree, as in the caſe of the willow fence already mentioned.

Shingle fence. The horizontal and upright ſhingle fence is formed in this manner; ſtout piles are driven into the earth, and deals of from half an inch to an inch thick, are nailed horizontally upon them, in ſuch a way, that the under edge of the uppermoſt deal projects over the upper edge of the one immediately below it, like ſlates or tiles upon houſes. In like manner, the ſhingles or boards may be placed perpendicularly, and bound together by being nailed to horizontal bars of wood.

The warped paling conſiſts of pieces of wood driven into the earth, which are twiſted and interwoven with each other, ſo as to form a very open net-work; the tops of the pieces of wood being bound together by willow or other twigs.

The light open fence with thorns, or branches of trees wove into it, is nothing more than a common paling, whoſe interſtices are filled up with thorns or branches of trees. It is a very effectual fence while it laſts.

Dead hedges, &c. Dead hedges are made of the prunings of trees or the tops of live hedges that have been cut down. They are ſometimes made upon the top of the mound of earth taken out of a ditch, by inſerting the thick ends of the twigs in the earth, and making them reſt in an oblique manner. Sometimes the ſtronger pieces or ſtakes are fixed in the earth, and the ſmaller twigs are uſed to faſten them together at top, by a kind of net-work. What is called the ſtake and rue fence in Scotland, conſiſts of a dead hedge or fence, formed of upright poſts, the intervals between which are filled up with

with twigs woven horizontally. All theſe, however, can only be regarded as fences of a very temporary nature, which are conſtantly in want of repairs, and therefore requiring a continual expence. Fences.

Before planting live hedges, it is proper to conſider the nature of the land, and what ſorts of plants will thrive beſt in it; and alſo, what is the ſoil from whence the plants are to be taken. As for the ſize, the ſets ought to be about the thickneſs of one's little finger, and cut within about four or five inches of the ground; they ought to be freſh taken up, ſtraight, ſmooth, and well-rooted. Thoſe plants that are raiſed in the nurſery are to be preferred. General directions for planting hedges.

In planting outſide hedges, the turf is to be laid with the graſs-ſide downwards, on that ſide of the ditch on which the bank is deſigned to be made; and ſome of the beſt mould ſhould be laid upon it to bed the quick, which is to be ſet upon it a foot aſunder. When the firſt row of quick is ſet, it muſt be covered with mould; and when the bank is a foot high, you may lay another row of ſets againſt the ſpaces of the former, and cover them as you did the others: the bank is then to be topped with the bottom of the ditch, and a dry or dead hedge laid, to ſhade and defend the under-plantation. Stakes ſhould then be driven into the looſe earth, ſo low as to reach the firm ground; theſe are to be placed at about two feet and a half diſtance: and in order to render the hedge yet ſtronger, you may edder it, that is, bind the top of the ſtakes with ſmall long poles, and when the eddering is finiſhed, drive the ſtakes anew.

The quick muſt be kept conſtantly weeded, and ſecured from being cropped by cattle; and in February Of managing the hawthorn.

it

Fences. it will be proper to cut it within an inch of the ground, which will cauſe it ſtrike root afreſh, and help it much in the growth.

Of the crab. The crab is frequently planted for hedges; and if the plants are raiſed from the kernels of the ſmall wild crabs, they are much to be preferred to thoſe raiſed from the kernels of all ſorts of apples without diſtinction; becauſe the plants of the true ſmall crab never ſhoot ſo ſtrong as thoſe of the apples, and may therefore be better kept within the proper compaſs of a hedge.

Black thorn. The black thorn, or ſloe, is frequently planted for hedges; and the beſt method of doing it, is to raiſe the plants from the ſtones of the fruit, which ſhould be ſown about the middle of January, if the weather will permit, in the place where the hedge is intended; but when they are kept longer out of the ground, it will be proper to mix them with ſand, and keep them in a cool place. The ſame fence will do for it when ſown, as when it is planted.

Holly. The holly is ſometimes planted for hedges; but where it is expoſed, there will be great difficulty in preventing its being deſtroyed: otherwiſe, it is by far the moſt beautiful plant; and, being an evergreen, will afford much better ſhelter for cattle in winter than any other ſort of hedge. The beſt method of raiſing theſe hedges is to ſow the ſtones in the place where the hedge is intended; and, where this can be conveniently done, the plants will make a much better progreſs than thoſe that are tranſplanted: but theſe berries ſhould be buried in the ground ſeveral months before they are ſown. The way to do this, is to gather the berries about Chriſtmas, when they are uſually ripe,

and

and put them into large flower-pots, mixing ſome ſand with them; then dig holes in the ground, into which the pots muſt be ſunk, covering them over with earth, about ten inches thick. In this place they muſt remain till the following October, when they ſhould be taken up, and ſown in the place where the hedge is intended to be made. The ground ſhould be well trenched, and cleared from the roots of all bad weeds, buſhes, trees, &c. Then two drills ſhould be made, at about a foot diſtance from each other, and about two inches deep, into which the ſeeds ſhould be ſcattered pretty cloſe, leſt ſome ſhould fail. When the plants grow up, they muſt be carefully weeded: and if they are deſigned to be kept very neat, they ſhould be cut twice a year, that is, in May and in Auguſt; but if they are only deſigned for fences, they need only be ſheered in July. The fences for theſe hedges, while young, ſhould admit as much free air as poſſible; the beſt ſort are thoſe made with poſts and rails, or with ropes drawn through holes made in the poſts; and if the ropes are painted over with a compoſition of melted pitch, brown Spaniſh colour and oil, well mixed, they will laſt ſeveral years. Fences.

Hedges for ornament in gardens are ſometimes planted with evergreens, in which caſe the holly is preferable to any other: next to this, moſt people prefer the yew; but the dead colour of its leaves renders thoſe hedges leſs agreeable. The laurel is one of the moſt beautiful evergreens; but the ſhoots are ſo luxuriant that it is difficult to keep it in any tolerable ſhape; and as the leaves are large, to prevent the diſagreeable appearance given them by their being cut through with the ſheers, it is beſt to prune Of garden hedges.

Fences. them with the knife, cutting the ſhoots juſt down to a leaf. The lauruſtinus is a very fine plant for this purpoſe; but the ſame objection may be made to this as to the laurel: this, therefore, ought only to be pruned with a knife in April when the flowers are going off; but the new ſhoots of the ſame ſpring muſt by no means be ſhortened. The ſmall-leaved and rough-leaved lauruſtinus are the beſt plants for this purpoſe. The true phillyrea is the next beſt plant for hedges, which may be led up to the height of 10 or 12 feet; and if they are kept narrow at the top, that there may be not too much width for the ſnow to lodge upon them, they will be cloſe and thick, and make a fine appearance. The ilex, or evergreen oak, is alſo planted for hedges, and is a fit plant for thoſe deſigned to grow very tall. The deciduous plants uſually planted to form hedges in gardens are, the hornbeam, which may be kept neat with leſs trouble than moſt other plants. The beech, which has the ſame good qualities as the hornbeam; but the gradual falling of its leaves in winter cauſes a continual litter. The ſmall-leaved Engliſh elm is a proper tree for tall hedges, but theſe ſhould not be planted cloſer than eight or ten feet. The lime-tree has alſo been recommended for the ſame purpoſe; but after they have ſtood ſome years, they grow very thin at bottom, and their leaves frequently turn of a black diſagreeable colour.

Of flowering ſhrubs. Many of the flowering ſhrubs have alſo been planted in hedges, ſuch as roſes, honeyſuckles, ſweet briars, &c. but theſe are difficult to train; and if they are cut to bring them within compaſs, their flowers, which are their greateſt beauty, will be entirely deſtroyed. A correſpondent

correſpondent of the ſociety for improving agriculture in Scotland, however, informs us, that he tried with ſucceſs the eglantine, ſweet-briar, or dog-roſe, when all the methods of making hedges practiſed in Eſſex and Hampſhire had been tried in vain. His method was to gather the hips of this plant, and to lay them in a tub till March: the ſeeds were then eaſily rubbed out; after which they were ſowed in a piece of ground prepared for garden peaſe. Next year they came up, and the year after they were planted in the following manner. After marking out the ditch, the plants were laid about 18 inches aſunder upon the ſide graſs, and their roots covered with the firſt turfs that were taken off from the ſurface of the intended ditch. The earth ſide of theſe turfs was placed next to the roots, and other earth laid upon the turfs which had been taken out of the ditch. In four or five years theſe plants made a fence which neither horſes nor cattle of any kind could paſs. Even in two or three years none of the larger cattle will attempt a fence of this kind. Sheep indeed will ſometimes do ſo, but they are always entangled to ſuch a degree, that they would remain there till they died unleſs relieved. Old briars dug up, and planted ſoon, make an excellent fence; and, where thin, it may be eaſily thickened by laying down branches, which, in one year, will make ſhoots of ſix or ſeven feet. They bear clipping very well. Fences.

Dr Anderſon, who hath treated the ſubject of hedging very particularly, is of opinion, that ſome other plants beſides thoſe above mentioned might be uſefully employed in the conſtruction of hedges. Among theſe Dr Anderſon's directions.

Fences. he reckons the common willow *. This, he ſays, by no means requires the wetneſs of ſoil which is commonly ſuppoſed. "It is generally imagined (ſays he), that the willow can be made to thrive nowhere except in wet or boggy ground: but this is one of thoſe vulgar errors, founded upon inaccurate obſervation, too often to be met with in ſubjects relating to rural affairs; for experience has ſufficiently convinced me, that this plant will not only grow, but thrive, in any rich well cultivated ſoil (unleſs in particular circumſtances that need not here be mentioned), even although it be of a very dry nature. It could not, however, in general be made to thrive, if planted in the ſame manner as thorns; nor would it, in any reſpect, be proper to train it up for a fence in the ſame way as that plant. The willow, as a fence, could ſeldom be ſucceſsfully employed, but for dividing into ſeparate incloſures any extenſive field of rich ground: and, as it is always neceſſary to put the ſoil into as good order as poſſible before a hedge of this kind is planted in it, the eaſieſt method of putting it into the neceſſary high tilth, will be to mark off the boundaries of your ſeveral fields in the winter, or early in the ſpring, with a deſign to give a complete fallow to a narrow ridge, ſix or eight feet broad, in the middle of which the hedge is intended to be planted the enſuing winter. This ridge ought to be frequently ploughed during the ſummer ſeaſon, and in the autumn to be well manured with dung or lime, or both (for it cannot be made too rich), and be neatly formed into a ridge before winter.

Of the willow.

"Having

* *Eſſays on Agriculture*, vol. i. p. 54. &c.

Fences.

" Having prepared the ground in this manner, it will be in readineſs to receive the hedge, which ought to be planted as early in winter as can be got conveniently done; as the willow is much hurt by being planted late in the ſpring."

Of planting hedges in expoſed ſituations, and recovering them when decayed.

The ſame author alſo gives the following uſeful directions for planting hedges in ſituations very much expoſed to the weather, and recovering them when on the point of decaying. " Thoſe who live in an open uncultivated country, have many difficulties to encounter, which others who inhabit more warm and ſheltered regions never experience; and, among theſe difficulties, may be reckoned that of hardly getting hedges to grow with facility. For, where a young hedge is much expoſed to violent and continued guſts of wind, no art will ever make it riſe with ſo much freedom, or grow with ſuch luxuriance, as it would do in a more ſheltered ſituation and favourable expoſure.

" But although it is impoſſible to rear hedges in this ſituation to ſo much perfection as in the others, yet they may be reared even there, with a little attention and pains, ſo as to become very fine fences.

" It is adviſeable in all caſes, to plant the hedges upon the face of a bank; but it becomes abſolutely neceſſary in ſuch an expoſed ſituation as that I have now deſcribed: for the bank, by breaking the force of the wind, ſcreens the young hedge from the violence of the blaſt, and allows it to advance, for ſome time at firſt, with much greater luxuriance than it otherwiſe could have done.

" But as it may be expected ſoon to grow as high as the bank, it behoves the provident huſbandman to prepare for that event, and guard, with a wiſe forecaſt,

Fences. againſt the inconvenience that may be expected to ariſe from that circumſtance.

"With this view, it will be proper for him, inſtead of making a ſingle ditch, and planting one hedge, to raiſe a pretty high bank, with a ditch on each ſide of it, and a hedge on each face of the bank; in which ſituation, the bank will equally ſhelter each of the two hedges while they are lower than it; and, when they at length become as high as the bank, the one hedge will in a manner afford ſhelter to the other, ſo as to enable them to advance with much greater luxuriance than either of them would have done ſingly.

"To effectuate this ſtill more perfectly, let a row of ſervice trees be planted along the top of the bank, at the diſtance of 18 inches from each other, with a plant of eglantine between each two ſervices. This plant will advance, in ſome degree, even in this expoſed ſituation; and by its numerous ſhoots, covered with large leaves, will effectually ſcreen the hedge on each ſide of it, which, in its turn, will receive ſome ſupport and ſhelter from them; ſo that they will be enabled to advance all together, and form, in time, a cloſe, ſtrong, and beautiful fence.

Service tree. "The *ſervice* is a tree but little known in Scotland, although it is one of thoſe that ought, perhaps, to be often cultivated there in preference to any other tree whatever, as it is more hardy, and, in an expoſed ſituation, affords more ſhelter, to other plants, than almoſt any tree I know; for it ſends out a great many ſtrong branches from the under part of the ſtem, which, in time, aſſume an upright direction, and continue to advance with vigour, and carry many leaves to the very bottom, almoſt as long as the tree exiſts; ſo that if it is

not

not pruned, it riſes a large cloſe buſh, till it attains the height of a foreſt tree. Fences.

" It is of the ſame genus with the mountain aſh, or rawn-tree, and has a great reſemblance to it both in flower and fruit; its branches are more waving and pliant; its leaves undivided, broad, and round, ſomewhat reſembling the elm, but white and mealy on the under ſide. It deſerves to be better known than it is at preſent.

" But if, from the poorneſs of the ſoil in which your hedge is planted, or from any other cauſe, it ſhould ſo happen, that, after a few years, the hedge becomes ſickly, and the plants turn poor and ſtunted in appearance, the eaſieſt and only effectual remedy for that diſeaſe, is to cut the ſtems of the plants clean over, at the height of an inch or two above the ground; after which they will ſend forth much ſtronger ſhoots than they ever would have done without this operation. And if the hedge be kept free from weeds, and trained afterwards in the manner above deſcribed, it will, in almoſt every caſe, be recovered, and rendered freſh and vigorous.

" This amputation ought to be performed in autumn, or the beginning of winter; and in the ſpring, when the young buds begin to ſhow themſelves, the ſtumps ought to be examined with care, and all the buds be rubbed off, excepting one or two of the ſtrongeſt and beſt placed, which ſhould be left for a ſtem. For if the numerous buds that ſpring forth round the ſtem are allowed to ſpring up undiſturbed, they will become in a few years as weak and ſtunted as before; and the hedge will never afterwards be able to attain any conſiderable height, ſtrength, or healthfulneſs.—I have ſeen many

Fences. hedges, that have been repeatedly cut over, totally ruined by this circumſtance not having been attended to in proper time.

"If the ground for 16 or 20 feet on each ſide of the hedge be fallowed at the time that this operation is performed, and get a thorough dreſſing with rich manures, and be kept in high order for ſome years afterwards by good culture and meliorating crops, the hedge will proſper much better than if this had been omitted; eſpecially if it had been planted on the level ground, or on the bank of a ſhallow ditch."

Of the black alder. Mr Miller greatly recommends the black alder as ſuperior to any other that can be employed in moiſt ſoils. It may either be propagated by layers or truncheons about three feet long. The beſt time for planting theſe laſt is in February or the month of March. They ought to be ſharpened at their largeſt end, and the ground well looſened before they are thruſt into it, leſt the bark ſhould be torn off, which might occaſion their miſcarriage. They ſhould be ſet at leaſt two feet deep, to prevent their being blown out of the ground by violent winds after they have made ſtrong ſhoots; and they ſhould be kept clear of tall weeds until they have got good heads, after which they will require no farther care. When raiſed by laying down the branches, it ought to be done in the month of October; and by that time twelvemonth they will have roots ſufficient for tranſplantation, which muſt be done by digging a hole and looſening the earth in the place where the plant is to ſtand. The young ſets muſt be planted at leaſt a foot and a half deep; and their top ſhould be cut off to within about nine inches of the ground; by which means they will ſhoot out

many

many branches. This tree may be trained into very thick and close heges, to the height of 20 feet and upwards. It will thrive exceedingly on the sides of brooks; for it grows best when part of its roots are in water; and may, if planted there, as is usual for willows, be cut for poles every fifth or sixth year. Its wood makes excellent pipes and staves; for it will last a long time under ground or in water: and it is likewise in great estimation among plough-wrights, turners, &c. as well as for making several of the utensils necessary for agriculture. Its bark also dies a good black. Fences.

The birch is another tree recommended by Mr Miller as proper for hedges; and in places where the young plants can be easily procured, he says, that the plantation of an acre will not cost 40 shillings, the after expence will not exceed 20 shillings: so that the whole will not come above three pounds. Ash trees ought never to be permitted in hedges, both because they injure the corn and grass by their wide extended roots, and likewise on account of the property their leaves have of giving a rank taste to butter made from the milk of such cattle as feed upon the leaves. No ash trees are permitted to grow in the good dairy counties. Of the birch.

Where there is plenty of rough flat stones, the fences which bound an estate or farm are frequently made with them. In Devonshire and Cornwall it is common to build, as it were, two walls with these stones laid upon one another; first two and then one between: as the wall rises they fill the intermediate space with earth, beat the stones in flat to the sides, which makes them lie very firm, and so proceed till the whole Of hedges raised on the top of stone fences.

Fences. whole is raiſed to the intended height. Quick hedges, and even large timber trees, are planted upon theſe walls, and thrive extremely well. Such encloſures are reckoned the beſt defence that can be had for the ground and cattle; though it can ſcarce be ſuppoſed but they muſt be diſagreeable to the eye, and ſtand in need of frequent repairs, by the ſtones being forced out of the way by cattle. The beſt way to prevent this is to build ſuch wall in the bottom of a ditch made wide enough on purpoſe, and ſloped down on each ſide. Thus the deformity will be hid; and as the cattle cannot ſtand to face the wall ſo as to attempt to leap over it, the ſtones of which it is compoſed will be leſs liable to be beaten down. The earth taken out of the ditch may be ſpread on the adjacent ground, and its ſides planted with ſuch trees or underwood as will beſt ſuit the ſoil. By leaving a ſpace of ſeveral feet on the inſide for timber, a ſupply of that valuable commodity may be had without doing any injury to the more valuable paſture.

Method of conſtructing an excellent fence in graſſy places.

The following is an excellent method of making a durable and beautiful fence in graſſy places. Dig pieces of turf four or five inches thick, the breadth of the ſpade, and about a foot in length. Lay theſe turfs even by a line on one ſide, with the graſs outward, at the diſtance of ten or twelve inches within the mark at which the ditch afterwards to be dug in the ſolid ground is to begin. Then lay, in the ſame manner, but with their graſs ſides turned out the contrary way, another row of turfs, at ſuch a diſtance as to make a breadth of foundation proportioned to the intended height of the bank. Thus, even though the ground ſhould prove defective, the bank would be prevented from

from giving way. A ditch may then be dug of what depth and breadth you pleaſe; or the ground may be lowered with a ſlope on each ſide; and, in this caſe, there will be no loſs of paſture by the fence; becauſe it may be ſowed with hay-ſeeds, and will bear graſs on both ſides. Part of the earth taken out of the ditches or ſlopes will fill the chaſm between the rows of turf, and the reſt may be ſcattered over the adjacent ground. Three, four, or more layers of turf, may be thus placed upon one another, and the interval between them filled up as before till the bank is brought to its deſired height; only obſerving to give each ſide of it a gentle ſlope for greater ſtrength. The top of this bank ſhould be about two feet and a half wide, and the whole of it filled up with earth, except a ſmall hollow in the middle to retain ſome rain. Quickſets ſhould then be planted along this top, and they will ſoon form an admirable hedge. By this means a bank four feet high, and a ſlope only two feet deep, will make, beſide the hedge, a fence ſix feet high, through which no cattle will be able to force their way: for the roots of the graſs will bind the turf ſo together, that in one year's time it will become entirely ſolid; and it will yet be much ſtronger when the roots of the quick ſhall have ſhot out among it. The only precautions neceſſary to be obſerved in making this bank are, 1. Not to make it when the ground is too dry; becauſe, if a great deal of wet ſhould ſuddenly follow, it will ſwell the earth ſo much as, perhaps, to endanger the falling of ſome of the outſide; which, however, is eaſily remedied if it ſhould happen. 2. If the ſlope be ſuch as ſheep can climb up, ſecure the young quicks, at the time of planting them, by a ſmall dead

Fences.

Fences. dead hedge, either on or near the top, on both ſides. If any of the quick ſhould die, which they will hardly be more apt to do in this than in any other ſituation, unleſs perhaps in extremely dry ſeaſons, they may be renewed by ſome of the methods already mentioned. Such fences will anſwer even for a park; eſpecially if we place poſts and rails, about two feet high, a little ſloping over the ſide of the bank, on or near its top: no deer can creep through this, nor even be able to jump over it. It is likewiſe one of the beſt fences for ſecuring cattle; and if the quicks on the banks be kept clipped, it will form a kind of green wall pleaſing to the eye.

Elms recommended. In the firſt volume of the Bath Papers we find elms recommended for fences; and the following method of raiſing them for this purpoſe is ſaid to be the beſt. When elm timber is felled in the ſpring, ſow the chips made in trimming or hewing them green, on a piece of ground newly ploughed, as you would corn, and harrow them in. Every chip which has an eye, or bud-knot, or ſome bark on it, will immediately ſhoot like the cuttings of potatoes; and the plants thus raiſed having no tap-roots, but ſhooting their fibres horizontally in the richeſt part of the ſoil, will be more vigorous, and may be more ſafely and eaſily tranſplanted than when raiſed from ſeeds, or in any other method. The plants thus raiſed for elm fences have greatly the advantage of others; as five, ſix, and ſometimes more, ſtems will ariſe from the ſame chip; and ſuch plants, if cut down within three inches of the ground, will multiply their ſide ſhoots in proportion, and make a hedge thicker, without running to naked wood, than by any other method yet practiſed. If kept clip-

ped

ped for three or four years, they will be almoſt impene- Fences.
trable.

In the ſecond volume of the ſame work, we meet with ſeveral obſervations on quick hedges by a gentleman near Bridgewater. He prefers the white and black thorns to all other plants for this purpoſe; but is of opinion, that planting timber trees in them at proper intervals is a very eligible and proper method. He raiſed ſome of his plants from haws in a nurſery; others he drew up in the woods, or wherever they could be found. His banks were made flat, and three feet wide at the top, with a ſloping ſide next the ditches, which laſt were dug only two feet below the ſurface, and one foot wide at bottom. The turfs were regularly laid, with the graſs downwards, on that ſide of the ditch on which the hedge was to be raiſed, and the beſt of the mould laid at top. The ſets were ſtraight, long, ſmooth, and even growing ones planted as ſoon as poſſible after taking up. They were planted at a foot diſtance; and about every 40 feet young fruit-trees, or thoſe of other kinds, ſuch as aſh, oak, elm, beech, as the ſoil ſuited them. A ſecond row of quickſets was then laid on another bed of freſh earth at the ſame time, and covered with good mould; after which the bank was finiſhed and ſecured properly from injuries by a dead hedge well wrought together, and faſtened by ſtakes of oak-trees on the top of the bank at three feet diſtance. Wherever any of the quickſets had failed or were of a dwindling appearance, he had them replaced with freſh ones from the nurſery, as well as ſuch of the young trees as had been planted on the top of the bank; and cleared the whole from weeds. Obſervations on quick hedges.

Fences.

Cyder fruit-trees recommended in hedges.

With regard to the advantage ariſing from hedges, our author obſerves, that "if they were of no farther uſe than as mere fences, it would be the farmer's intereſt to keep them up carefully; for the better they are, the more ſecure are his cattle and crops. But if a judicious mixture of cyder fruit-trees were planted in hedges, the profit ariſing from them only would abundantly repay the coſt of the whole without any loſs of ground. It may poſſibly be objected by ſome, that the hedges would often be hurt by the boys climbing up to get the fruit; but thoſe who make it ſhould remember, or be told, that the beſt kinds of cyder-fruit are ſo hard and auſtere at the time of their being gathered, that nobody can eat them, and even hogs will hardly touch them. But the greateſt benefit, where no fruit-trees are planted, ariſes from the thorns and wood which quick hedges yield for the fire and other purpoſes."

Method of raiſing hornbeam hedges in Germany.

The author of the Eſſay on Huſbandry recommends the hornbeam plant as one of the beſt yet known for making fences, according to the method practiſed in Germany, where ſuch fences are common. "When the German huſbandman (ſays he) erects a fence of this nature, he throws up a parapet of earth, with a ditch on each ſide, and plants his hornbeam ſets in ſuch a manner, that every two plants may be brought to interſect each other in the form of St Andrew's croſs. In that part where the two plants croſs each other, he gently ſcrapes off the bark, and binds them with ſtraw thwartwiſe. Here the two plants conſolidate in a kind of indiſſoluble knot, and puſh from thence horizontal ſlanting ſhoots, which form a ſort of living paliſado or *chevaux de friſe*; ſo that ſuch a protection may be called a

rural fortification. The hedges being pruned annually, and with diſcretion, will in a few years render the fence impenetrable in every part. Fences.

" It ſometimes happens (ſays Dr Anderſon) that a hedge may have been long neglected, and be in general in a healthy ſtate, but full of gaps and openings, or ſo thin and ſtraggling, as to form but a very imperfect ſort of fence. On theſe occaſions, it is in vain to hope to fill up the gaps by planting young quicks; for theſe would always be outgrown, choked, and ſtarved, by the old plants: nor could it be recovered by cutting clear over by the roots, as the gaps would ſtill continue where they formerly were. The only methods that I know of rendering this a fence are, either to mend up the gaps with deal wood, or to *plaſh* the hedge; which laſt operation is always the moſt eligible where the gaps are not too large to admit of being cured by this means. Dr Anderſon's method of mending decayed hedges.

" The operation I here call *plaſhing*, may be defined, " a wattling made of living wood." To form this, ſome ſtems are firſt ſelected, to be left as ſtakes at proper diſtances, the tops of which are all cut over at the height of four feet from the root. The ſtraggling ſide-branches of the other part of the hedge are alſo lopped away. Several of the remaining plants are then cut over, cloſe by the ground, at convenient diſtances; and the remaining plants are cut perhaps half through, ſo as to permit them to be bent to one ſide. They are then bent down almoſt to a horizontal poſition, and interwoven with the upright ſtakes, ſo as to retain them in that poſition. Care ought to be taken that theſe be laid very low at thoſe places where there were formerly gaps; which ought to be farther ſtrengthened

by

Fences. by ſome dead ſtakes or truncheons of willows, which will frequently take root in this caſe, and continue to live. And ſometimes a plant of eglantine will be able to overcome the difficulties it there meets with, ſtrike root, and grow up ſo as to ſtrengthen the hedge in a moſt effectual manner.

" The operator begins at one end of the field, and proceeds regularly forwards, bending all the ſtems in one direction, ſo that the points riſe above the roots of the others, till the whole wattling is completed to the ſame height as the uprights.

" An expert operator will perform this work with much greater expedition than one who has not ſeen it done could eaſily imagine. And as all the diagonal wattlings continue to live, and ſend out ſhoots from many parts of their ſtems, and as the upright ſhoots that riſe from the ſtumps of thoſe plants that have been cut over quickly ruſh up through the whole hedge, theſe ſerve to unite the whole into one entire maſs, that forms a ſtrong, durable, and beautiful fence.

" This is the beſt method of recovering an old neglected hedge that hath as yet come to my knowledge.

" In ſome caſes it happens, that the young ſhoots of a hedge are killed every winter; in which caſe it ſoon becomes dead and unſightly, and can never riſe to any conſiderable height. A remedy for this diſeaſe may therefore be wiſhed for.

" Young hedges are obſerved to be chiefly affected with this diſorder; and it is almoſt always occaſioned by an injudicious management of the hedge, by means of which it has been forced to ſend out too great a number of ſhoots in ſummer, that are thus rendered ſo

ſmall

ſmall and weakly as to be unable to reſiſt the ſevere weather in winter. Fences.

" It often happens, that the owner of a young hedge, with a view to render it very thick and cloſe, cuts it over with the ſheers a few inches above the ground the firſt winter after planting; in conſequence of which, many ſmall ſhoots ſpring out from each of the ſtems that has been cut over:—Each of which, being afterwards cut over in the ſame manner, ſends forth a ſtill greater number of ſhoots, which are ſmaller and ſmaller in proportion to their number.

" If the ſoil in which the hedge has been planted is poor, in conſequence of this management, the branches, after a few years, become ſo numerous, that the hedge is unable to ſend out any ſhoots at all, and the utmoſt exertion of the vegetative powers enables it only to put forth leaves. Theſe leaves are renewed in a ſickly ſtate for ſome years, and at laſt ceaſe to grow at all—the branches become covered with fog, and the hedge periſhes entirely.

" But if the ſoil be very rich, notwithſtanding this great multiplication of the ſtems, the roots will ſtill have ſufficient vigour to force out a great many ſmall ſhoots, which advance to a great length, but never attain a proportional thickneſs. And as the vigour of the hedge makes them continue to vegetate very late in autumn, the froſts come on before the tops of theſe dangling ſhoots have attained any degree of woody firmneſs, ſo that they are killed almoſt entirely by it; the whole hedge becomes covered with theſe long dead ſhoots, which are always diſagreeable to look at, and uſually indicate the approaching end of the hedge.

Fences. "The cauſes of the diſorder being thus explained, it will readily occur, that the only radical cure is amputation; which, by giving an opportunity to begin with training the hedge anew, gives alſo an opportunity of avoiding the errors that occaſioned it. In this caſe, care ought to be taken to cut the plants as cloſe to the ground as poſſible, as there the ſtems will be leſs numerous than at any greater height. And particular attention ought to be had to allow very few ſhoots to ariſe from the ſtems that have been cut over, and to guard carefully againſt ſhortening them.

"But as the roots, in the caſe here ſuppoſed, will be very ſtrong, the ſhoots that are allowed to ſpring from the ſtems will be very vigorous, and there will be ſome danger of their continuing to grow later in the ſeaſon than they ought in ſafety to do; in which caſe, ſome part of the top of the ſhoot may perhaps be killed the firſt winter, which ought, if poſſible, to be prevented. This can only be effectually done by giving a check to the vegetation in autumn, ſo as to allow the young ſhoots to harden in the points before the winter approaches. If any of the leaves or branches of a tree are cut away while it is in the ſtate of vegetation, the whole plant feels the loſs, and it ſuffers a temporary check in its growth in proportion to the loſs that it thus ſuſtains. To check, therefore, the vigorous vegetation at the end of autumn, it will be prudent to chooſe the beginning of September for the time of lopping off all the ſupernumerary branches from the young hedge, and for clipping off the ſide-branches that have ſprung out from it; which will, in general, be ſufficient to give it ſuch a check in its growth at that ſeaſon, as will prevent any of the ſhoots from advancing afterwards.

afterwards. If the hedge is extremely vigorous, a few buds may be allowed to grow upon the large ſtumps in the ſpring, with a view to be cut off at this ſeaſon, which will tend to ſtop the vegetation of the hedge ſtill more effectually. Fences.

"By this mode of management, the hedge may be preſerved entire through the firſt winter. And as the ſhoots become leſs vigorous every ſucceſſive ſeaſon, there will be leſs difficulty in preſerving them at any future period. It will always be proper, however, to trim the ſides of a very vigorous hedge for ſome years while it is young, about the ſame ſeaſon of the year, which will tend powerfully to prevent this malady. But when the hedge has advanced to any conſiderable height, it will be equally proper to clip it during any of the winter-months, before Candlemas."

Lord Kaimes, in his work entitled the Gentleman Farmer, gives ſeveral directions for the raiſing and mending of hedges conſiderably different from thoſe above related. For a deer-park he recommends a wall of ſtone coped with turf, having laburnums planted cloſe to it. The heads of the plants are to be lopped off, in order to made the branches extend laterally, and interweave in the form of a hedge. The wall will prevent the deer from breaking through; and if the hedge be trained eight feet high, they will not attempt to leap over. He prefers the laburnum plant, becauſe no beaſt will feed upon it except a hare, and that only when young and the buſh tender. Therefore, no extraordinary care is neceſſary, except to preſerve them from the hare for four or five years. A row of alders may be planted in front of the laburnums, which no hare nor any other beaſt will touch. The wall he re- Lord Kaimes's obſervations. Fence for deer-park.

Fences. commends to be built in the following manner, as being both cheaper and more durable than one conſtructed entirely of ſtone. Raiſe it of ſtone to the height of two feet and a half from the ground, after which it is to be coped with ſod as follows: Firſt, lay on the wall, with the graſſy ſide under, ſod cut with the ſpade four or five inches deep, and of a length equal to the thickneſs of the wall. Next, cover this ſod with looſe earth rounded like a ridge. Third, prepare thin ſod, caſt with the paring ſpade, ſo long as to extend beyond the thickneſs of the wall, two inches on each ſide. With theſe cover the looſe earth, keeping the graſſy ſide above; place them ſo much on the edge, that each ſod ſhall cover part of another, leaving only about two inches without cover: when 20 or 30 yards are thus finiſhed, let the ſod be beat with mallets by two men, one on each ſide of the wall, ſtriking both at the ſame time. By this operation, the ſod becomes a compact body that keeps in the moiſture, and encourages the graſs to grow. Laſtly, Cut off the ragged ends of the ſod on each ſide of the wall, to make the covering neat and regular. The month of October is the proper ſeaſon for this operation, becauſe the ſun and wind, during ſummer, dry the ſod, and hinder the graſs from vegetating. Moiſt ſoil affords the beſt ſod. Wet ſoil is commonly too fat for binding; and, at any rate, the watery plants it produces will not thrive in a dry ſituation. Dry ſoil, on the other hand, being commonly ill bound with roots, ſhakes to pieces in handling. The ordinary way of coping with ſod, which is to lay them flat and ſingle, looks as if intended to dry the ſod and kill the graſs; not to mention

that

that the ſoil is liable to be blown off the wall by every high wind. Fences.

The advantages of a thorn hedge, according to our author, are, that it is a very quick grower, when planted in a proper ſoil; ſhooting up ſix or ſeven feet in a ſeaſon. Though tender and apt to be hurt by weeds when young, it turns ſtrong, and may be cut into any ſhape. Even when old, it is more diſpoſed than other trees to lateral ſhoots; and laſtly, its prickles make it the moſt proper of all for a fence. None of theſe thorns ought to be planted in a hedge till five years of age, and it is of the utmoſt importance that they be properly trained in the nurſery. The beſt ſoil for a nurſery, his lordſhip obſerves, is between rich and poor. In the latter the plants are dwarfiſh: in the former, being luxuriant and tender, they are apt to be hurt during the ſeverity of the weather; and theſe imperfections are incapable of any remedy. An eſſential requiſite in a nurſery is free ventilation. "How common (ſays his lordſhip) is it to find nurſeries in hollow ſheltered places, ſurrounded with walls and high plantations, more fit for pine-apples than barren trees! The plants thruſt out long ſhoots, but feeble and tender: when expoſed in a cold ſituation, they decay, and ſometimes die. But there is a reaſon for every thing: the nurſeryman's view is to make profit by ſaving ground, and by impoſing on the purchaſer tall plants, for which he pretends to demand double price. It is ſo difficult to purchaſe wholeſome and well nurſed plants, that every gentleman farmer ought to raiſe plants for himſelf.

Advantages of a thorn hedge.

Of a proper nurſery for raiſing the plants.

"As thorns will grow pleaſantly from roots, I have long practiſed a frugal and expeditious method of raiſing

Of raiſing them from the roots of old hedges.

Fences. raiſing them from the wounded roots that muſt be cut off when thorns are to be ſet in a hedge. Theſe roots cut into ſmall parts, and put in a bed of freſh earth, will produce plants the next ſpring no leſs vigorous than what are produced from ſeed; and thus a perpetual ſucceſſion of plants may be obtained without any more ſeed. It ought to be a rule, never to admit into a hedge plants under five years old; they deſerve all the additional ſum that can be demanded for them. Young and feeble plants in a hedge are of ſlow growth; and, beſides the loſs of time, the paling neceſſary to ſecure them from cattle muſt be renewed more than once before they become a fence. A thorn hedge may be planted in every month of winter and ſpring, unleſs it be froſt. But I have always obſerved, that thorns planted in October are more healthy, puſh more vigorouſly, and fewer decay, than at any other time. In preparing the thorns for planting, the roots ought to be left as entire as poſſible, and nothing cut away but the ragged parts.

Proper method of planting. "As a thorn hedge ſuffers greatly by weeds, the ground where they are planted ought to be made perfectly clean. The common method of planting, is to leave eight or nine inches along a ſide of the intended ditch, termed a *ſcarſement;* and behind the ſcarſement to lay the ſurface ſoil of the intended ditch, cut into ſquare ſods two or three inches deep, its graſſy ſurface under. Upon that ſod, whether clean or dirty, the thorns are laid, and the earth of the ditch above them. The graſs in the ſcarſement, with what weeds are in the moved earth, ſoon grow up, and require double diligence to prevent the young thorns from being choked. The following method deſerves all the addition-

al

al trouble it requires. Leaving a ſcarſement as above of 10 inches, and alſo a border for the thorns, broad or narrow according to their ſize; lay behind the border all the ſurface of the intended ditch, champed ſmall with the ſpade, and upon it lay the earth that fell from the ſpade in cutting the ſaid ſurface. Cover the ſcarſement and border with the under earth, three inches thick at leaſt; laying a little more on the border to raiſe it higher than the ſcarſement, in order to give room for weeding. After the thorns are prepared by ſmoothing their ragged roots with a knife, and lopping off their heads to make them grow buſhy, they are laid fronting the ditch, with their roots on the border, the head a little higher than the root. Care muſt be taken to ſpread the roots among the ſurface-earth taken out of the ditch, and to cover them with the mouldery earth that lay immediately below. This article is of importance, becauſe the mouldery earth is the fineſt of all. Cover the ſtems of the thorns with the next ſtratum of the ditch, leaving always an inch at the top free. It is no matter how poor this ſtratum be, as the plants draw no nouriſhment from it. Go on to finiſh the ditch, preſſing down carefully every row of earth thrown up behind the hedge, which makes a good ſolid mound impervious to rain. It is a ſafeguard to the young hedge to raiſe this mound as perpendicular as poſſible; and for that reaſon, it may be proper, in looſe ſoil, when the mound is raiſed a foot or ſo, to bind it with a row of tough ſod, which will ſupport the earth above till it become ſolid by lying. In poor ſoil more care is neceſſary. Behind the line of the ditch the ground intended for the ſcarſement and border ſhould be ſummer-fallowed, manured, and clear- Fences.

Fences. ed of all graſs roots; and this culture will make up for the inferiority of the ſoil. In very poor ſoils, it is vain to think of planting a thorn hedge. In ſuch ground there is a neceſſity for a ſtone fence.

"The only reaſon that can be given for laying thorns as above deſcribed, is to give the roots ſpace to puſh in all directions; even upward into the mound of earth. There may be ſome advantages in this; but, in my apprehenſion, the diſadvantage is much greater of heaping ſo much earth upon the roots as to exclude not only the ſun, but the rain which runs down the ſloping bank, and has no acceſs to the roots. Inſtead of laying the thorns fronting the ditch, would it not do better to lay them parallel to it; covering the roots with three or four inches of the beſt earth, which would make a hollow between the plants and the ſloping bank? This hollow would intercept every drop of rain that falls on the bank, to ſink gradually among the roots. Why, at any rate, ſhould a thorn be put into the ground ſloping? This is not the practice with regard to any other tree; and I have heard of no experiment to perſuade me that a thorn thrives better ſloping than erect. There occurs indeed, one objection againſt planting thorns erect, that the roots have no room to extend themſelves on that ſide where the ditch is. But does it not hold, that when, in their progreſs, roots meet with a ditch, they do not puſh onward; but, changing their direction, puſh downward at the ſide of the ditch? If ſo, theſe downward roots will ſupport the ditch, and prevent it from being mouldered down by froſt. One thing is evident without experiment, that thorns planted erect may ſooner be made a complete fence than when laid ſloping as uſual. In the

the latter caſe, the operation is confined to thorns that do not exceed a foot or fifteen inches; but thorns five or ſix feet high may be planted erect; and a hedge of ſuch thorns, well cultivated in the nurſery, will in three years arrive at greater perfection than a hedge managed in the ordinary way will do in twice that time." Fences.

After the hedge is finiſhed, it is abſolutely neceſſary to ſecure it for ſome time from the depredations of cattle; and this is by no means an eaſy matter. "The ordinary method of a paling (ſays his lordſhip) is no ſufficient defence againſt cattle: the moſt gentle make it a rubbing poſt, and the vicious wantonly break it down with their horns. The only effectual remedy is expenſive; viz. two ditches and two hedges, with a mound of earth between them. If this remedy, however, be not palatable, the paling ought, at leaſt, to be of the ſtrongeſt kind. I recommend the following as the beſt I am acquainted with: Drive into the ground ſtrong ſtakes three feet and a half long, with intervals from eight to twelve inches, according to the ſize of the cattle that are to be encloſed; and all preciſely of the ſame height. Prepare plates of wood ſawed out of logs, every plate three inches broad and half an inch thick. Fix them on the head of the ſtakes with a nail driven down into each. The ſtakes will be united ſo firmly, that one cannot be moved without the whole; and will be proof accordingly againſt the rubbing of cattle. But, after all, it is no fence againſt vicious cattle. The only proper place for it is the ſide of a high road, or to fence a plantation of trees. It will indeed be a ſufficient fence againſt ſheep, and endure till the hedge itſelf becomes a fence. A fence Of ſecuring a hedge after it is planted.

thus

Fences. thus completed, including thorns, ditching, wood, nails, &c. will not much exceed two ſhillings every ſix yards."

Of training up hedges. His lordſhip diſapproves of the ordinary method of training hedges by cutting off the top and ſhortening the lateral branches in order to make it thick and buſhy. This, as well as the method of cutting off the ſtems two or three inches above the ground, indeed produces a great number of ſhoots, and makes a very thick fence, but which becomes ſo weak when bare of leaves, that cattle break through it in every part. To determine the beſt method of proceeding in this caſe, his lordſhip made an experiment on three hedges, which were twelve years old at the time he wrote. The firſt was annually pruned at the top and ſides; the ſides of the ſecond were pruned, but not the top; and the third was allowed to grow without any pruning. The firſt, at the time of writing, was about four feet broad, and thick from top to bottom; but weak in the ſtems, and unable to reſiſt any horned beaſt: the ſecond was ſtrong in its ſtems, and cloſe from top to bottom: the third was alſo ſtrong in its ſtems, but bare of branches for two feet from the ground; the lower ones having been deprived of air and rain by the thick ſhade of thoſe above them. Hence he directs that hedges ſhould be allowed to grow till the ſtems be five or ſix inches in circumference, which will be in ten or twelve years; at which time the hedge will be fifteen feet or more in height. The lateral branches next the ground muſt be pruned within two feet of the ſtem; thoſe above muſt be made ſhorter and ſhorter in proportion to their diſtance from the ground; and at five feet high they muſt be cut cloſe to the ſtem, leaving

ing all above full freedom of growth. By this dreſſing the hedge takes on the appearance of a very ſteep roof; and it ought to be kept in that form by pruning. This form gives free acceſs to rain, ſun, and air: every twig has its ſhare, and the whole is preſerved in vigour. When the ſtems have arrived at their proper bulk, cut them over at five feet from the ground, where the lateral branches end. This anſwers two excellent purpoſes: the firſt is to ſtrengthen the hedge, the ſap that formerly aſcended to the top being now diſtributed to the branches; the next is, that a tall hedge ſtagnates the air, and poiſons both corn and graſs near it. A hedge trained in this manner is impenetrable even by a bull. Fences.

With regard to the practice of *plaſhing* an old hedge recommended by Dr Anderſon, his lordſhip obſerves, that "it makes a good interim fence, but, at the long run, is deſtructive to the plants; and accordingly there is ſcarcely to be met with a complete good hedge where plaſhing has been long practiſed. A thorn is a tree of long life. If, inſtead of being maſſacred by plaſhing, it were raiſed and dreſſed in the way here deſcribed, it would continue a firm hedge perhaps 500 years. Plaſhing of hedges diſapproved of.

In the fourth volume of Mr Young's Northern Tour,* the author recommends the tranſplanting of old hedges, which his correſpondent Mr Beverly ſays he has tried with prodigious ſucceſs.

Mr Bakewell, we are told, is very curious in his fences, and plants his quicks in a different manner from what Mr Bakewell's fences.

* *Annals of Agriculture*, vol. vi. p. 357. ib. p. 494.

Fences. what is common in various parts of the kingdom. He plants one row at a foot from ſet to ſet, and making his ditch, lays the earth which comes out of it to form a bank on the ſide oppoſite to the quick. In the common method, the bank is made on the quick ſide above it. Reaſons are not wanting to induce a preference of this method. The plants grow only in the furface earth uncovered from the atmoſphere, which muſt neceſſarily be a great advantage; whereas, in the uſual way of planting, that earth, which is always the beſt, is loaded by a thick covering obliquely of the earth out of the ditch. If the roots ſhoot in the beſt ſoil, they will be out of the reach of the influences of the air; the conſequence of which is, that they cannot have ſo large a ſpace of that earth as if ſet on the flat. The way to have a tree or a quick thrive in the beſt manner poſſible, is to ſet it on the ſurface without any ditch or trench, that cuts off half its paſture. But if a ditch is neceſſary, the next beſt way muſt of courſe be ſtill to keep it on the flat ſurface; and the worſt way to cover up that ſurface, by loading it with the dead earth out of a trench. To ſay that there are good hedges in the common method is not a concluſive argument, unleſs both were tried on the ſame ſoil and expoſure.

Of hedges in ſtony and gravelly ſoils. In the 7th volume of the ſame work, a correſpondent, who ſigns himſelf M. M. obſerves, that notwithſtanding all the improvements that have been made in the conſtruction of hedges and fences, there are many ſoils in England, which, from their ſandy and gravelly natures, are little adapted to any of the plants in common uſe, and are therefore ſubject to all the inconveniences of dead hedges and gaps. Of this kind

are

are all the ſandy and gravelly encloſures, which conſtitute ſo large a part of many diſtricts in the iſland. Fences.

For theſe our author recommends a triple row of furze; though, notwithſtanding its advantages, he ſays it is liable to be deſtroyed by ſevere winters, contrary to the aſſertion of Lord Kaimes above related. "It is liable (ſays he) to be ſo completely cut off by a ſevere winter, that I have ſeen tracts of many hundred acres laid open in the ſpace of a few weeks, and reduced to as defenceleſs a ſtate as the ſurrounding waſtes. On ſuch ſoils therefore he recommends the holly; the only diſadvantage of which, he ſays, is its ſlow growth. On moſt of theſe ſoils alſo the black thorn will riſe ſpontaneouſly; and even the quick, though ſlowly, will advance to a ſufficient degree of perfection. The birch, however, he particularly recommends, as growing equally on the drieſt and on the wetteſt ſoils, propagating itſelf in ſuch numbers, that, were they not deſtroyed, all the ſandy waſtes of this kingdom would be quickly covered with them. He recommends particularly the keeping of a nurſery for ſuch plants as are commonly uſed for hedges. "I generally (ſays he) pick out a bit of barren land, and after ploughing it three or four times to bury and deſtroy the heath, I find it anſwer extremely well for a nurſery. Into this ſpot I tranſplant quick, hollies, and every tree which I uſe for fences or plantations. By eſtabliſhing ſuch a nurſery, a gentleman will always be able to command a ſufficiency of ſtrong and hardy plants which will not deceive his expectations. I look upon thorns of five or ſix years old, which have been twice tranſplanted from the ſeed-bed, to be the beſt of all; but as it may be neceſſary to fill up caſual gaps Of a proper nurſery.

in

Fences. in hedges that have been planted ſeveral years, a proviſion ſhould be made of plants of every age, to twelve or fourteen years old. All plants which are intended to be moved, ſhould be tranſplanted every two, or at moſt three years; without this attention, they attach themſelves ſo firmly to the ſoil as renders a ſubſequent operation dangerous. All who tranſplant quicks or hollies ought to begin their labours as early as convenient in the autumn; for I have found, by repeated experience, that neither of theſe plants ſucceeds ſo well in the ſpring."

Of repairing ruinous hedges. Where the fences of a tract of ground are in a very ruinous condition, it is abſolutely neceſſary to ſcour the ditches, throw up the banks, and ſecure the whole immediately by the firmeſt dead fences we can procure. If there is a total want of living plants, the cultivator can do nothing but plant new hedges; but if, as is generally the caſe, the banks are furniſhed with a multitude of old ſtems, though totally unconnected as a fence, the time and labour requiſite for the intended improvement will be conſiderably abridged. All the ſtraggling branches, which add no ſolidity to the fence, are to be cut off; after which the reſt of the ſtems muſt be ſhortened to the height of three or four feet. The method of cutting down every thing to the ground, which is now ſo general, our author highly condemns. "Such a fence (ſays he) has within it no principle of ſtrength and connection; it is equally expoſed in every part to depredations of cattle and ſportſmen; and even ſhould it eſcape theſe, the firſt fall of ſnow will nearly demoliſh it. On the contrary, wherever theſe vegetable paliſades can be left, they are impenetrable either for man

or

or horſe, and form ſo many points of union which ſup- Fences.
port the reſt."

Another method of ſtrengthening defective fences is, to bend down ſome of the lateral ſhoots in a horizontal direction, and to ſpread them along the line of the farm, like eſpalier trees in a garden. A ſingle ſtem, when it riſes perpendicularly, will not ſecure a ſpace of more than two or three feet, but when bent longitudinally, it will form a barrier at leaſt ſufficient to repel all cattle but hogs for twelve or fourteen on one ſide. By bending down, our author does not mean the common *plaſhing* method, which is very injurious to the plants; but the ſpreading two or three of the moſt convenient branches along the hedge, and faſtening them down either by pegs or tying, without injury to the ſtem, until they habitually take the propoſed direction. Thoſe who make the experiment for the firſt time will be aſtoniſhed how ſmall a number of plants may be made to fill a bank, with only trifling intervals. The birch is particularly uſeful for this purpoſe; being of ſo flexible a nature, that ſhoots of ten or twelve feet in length may be eaſily forced into a horizontal direction; and if the other ſhoots are pruned away, all the juices of the plant will be applied to nouriſh the ſelected few: by which means they will in a few years acquire all the advantages of poſts and rails, with this material difference, that inſtead of decaying, they become annually better. It is beſides the property of all inclined branches to ſend up a multitude of perpendicular ſhoots; ſo that by this horizontal inclination, if judiciouſly made, you may acquire almoſt all the advantages of the thickeſt fence; but when the ſtems are too old and brittle to bear this operation,

Plaſhing of hedges diſapproved.

Fences.

operation, it will be adviſeable to cut off all the uſeleſs ones cloſe to the ground, and next ſpring they will be ſucceeded by a number of young and vigorous ones. Select the beſt of theſe to be trained in the manner already directed, and extirpate all the reſt, to increaſe their vigour. The ſhoots of ſuch old ſtems as have been juſt now deſcribed will attain a greater ſize in three or four years than any young ones that can be planted will do in twelve.

In what caſe the cutting down of hedges is proper.

It frequently happens, ſays the ſame writer, that the fences of a eſtate have been neglected for many years, and exhibit nothing but ragged and deformed ſtems at great intervals. In this caſe, it will be proper to cut them all off level with the ground: the conſequence of this is, that next year they will put forth a great number of ſhoots, which may be laid down in every direction, and trained for the improvement of the fence. When this operation is performed, however, it ought always to be done, with an axe, and not with a ſaw; it being found that the latter inſtrument generally prevents the vegetation of the plant. All the ſhoots laid down in this manner ſhould be allowed to remain for ſeveral years, that they may be firmly rooted. Thus they will make prodigious advances; and it is to be obſerved, that the more the parent plant is diveſted of all ſuperfluous branches, the greater will be the nouriſhment tranſmitted to the ſcions.

Our author, however, is inclined to ſuſpect that the moſt perfect form of a hedge, at leaſt in all but thoſe compoſed of thorns and prickly plants, is to train up as many ſtems as will nearly touch each other. The force of every fence conſiſts chiefly in the upright ſtems: where theſe are ſufficiently near and

ſtrong,

ſtrong, the hedge reſiſts all oppoſition, and will equally repel the violence of the bull, and the inſidious attacks of the hogs. It is abſolutely proper that all hedges ſhould be inſpected once a-year; when not only the ditch ought to be thrown out, and the bank ſupported, but the ſtraggling ſhoots of all the live plants ought to be pruned. By theſe are meant all ſuch as project over the ditch beyond the line of the hedge, and which add nothing to its ſtrength, though they deprive the uſeful ſtems of part of their nouriſhment. Where a hedge is compoſed of plants of inferior value, it will be proper to train thoſe in the manner juſt now recommended, and to plant the bank with quick or holly. When theſe laſt have attained a ſufficient ſize, the others may be extirpated; which is beſt done by cutting down all the ſhoots repeatedly in the ſummer, and leaving the roots to rot in the hedge. Fences.

In the 13th volume of the Annals of Agriculture, W. Erſkine, Eſq. gives an account of a method of fencing very much reſembling that recommended by Lord Kaimes. That gentleman is of opinion, that, in ſome caſes *dead ſtone walls*, as they are called, are more advantageous than hedges. "That hedges (ſays he) are more ornamental, cannot be denied; and they are generally allowed to afford more ſhelter; but the length of time, the conſtant attention, and continual expence of defending them until they bear even the reſemblance of a fence, induces many people in thoſe places where the materials are eaſily procured, to prefer the dry ſtone walls; for though the firſt coſt is conſiderable, yet as the farmer reaps the immediate benefit of the fence (which is undoubtedly Mr Erſkine's method of conſtructing hedges.

Fences. the moſt ſecure one), they are thought on the whole to be the leaſt expenſive; beſides, the cattle in expoſed ſituations, and eſpecially in theſe northern parts, are ſo impatient of confinement at the commencement of the long, cold, wet nights, that no hedges I have ever yet ſeen, in any part of this iſland, are ſufficient to keep them in."

From conſiderations of this kind, the late Sir George Suttie of Eaſt Lothian was induced to think of a fence which might join the ſtrength of the wall to the ornament of the hedge. His thorns were planted in the uſual manner on the ſide of the ditch: but inſtead of putting behind them a poſt and rail or paling on the top of the bank, he erected a wall two feet and a half high; and being well ſituated for procuring lime, he uſed it in the conſtruction of theſe walls which Mr Erſkine greatly recommends; "as the ſatisfaction they afford, by requiring no repairs, and the duration of them, more than repay the expence: but, where the price of lime is high, they may be built without any cement, and anſwer the purpoſe very well, if the work is properly executed."

In making a new fence of this kind, the ſurface of the ground ſhould be pared off the breadth of the ditch, and likewiſe for two feet more, in order to prevent as much as poſſible the thorns from being injured by the growth of graſs and weeds. The ditch ſhould be five feet broad, two and a half in depth, and one foot broad at the bottom. Leave one foot for an edging or ſcarſement, then dig the earth one ſpit of a ſpade for about one foot, and put about three inches of good earth below the thorn, which ſhould be laid nearly horizontal, but the point rather inclining upwards,

wards, in order to let the rain drip to the roots; then add a foot of good earth above it: leave three or four inches of a ſcarſement before another thorn is planted; it muſt not be directly over the lower one, but about nine inches or a foot to one ſide of it: then throw a foot of good earth on the thorn, and trample it well down, and level the top of the bank for about three feet and a half for the baſe of the wall to reſt on. This baſe ſhould be about nine or ten inches, but muſt not exceed one foot from the thorn. The wall ought to be about two feet thick at the bottom and one foot at the top: the cope to be a ſingle ſtone laid flat; then covered with two ſods of turf, the graſs of the undermoſt to be next the wall, and the other ſod muſt have the graſs ſide uppermoſt. The ſods ſhould be of ſome thickneſs, in order to retain moiſture; ſo that they may adhere together, and not be eaſily diſplaced by the wind. The height of the wall to be two feet and a half, excluſive of the ſods; which together ſhould be from four to ſix inches, by which means the wall would be near to three feet altogether. The expence of the fences cannot ſo eaſily be counted, on account of the difference of the prices of labour in different parts. Mr Erſkine had them done with lime, every thing included, from 10½ to 13d. per ell (which is equal to 37 inches 2 parts), according to the eaſe or difficulty of working the quarry, and the diſtance of it from the place where the fence is erected. The lime coſts about 6d. per boll of about 4.0872667 buſhels; and from 15 to 16 bolls of lime are uſed to the rood of 36 ſquare ells Scots meaſure; and there are upwards of 43 Scots ells, or 44 Engliſh yards. When the common round or flint ſtones are made uſe of, as they require more lime, it is

Fences. neceſſary to uſe 30 or 35 bolls of lime to the rood. The thorns are ſold from five to ten ſhillings per thouſand, according to their age, reckoning ſix ſcore to the hundred. Making the ditch, laying the thorns, and preparing the top of the wall, generally coſt from 7d. to 8d. every ſix ells. About 50 carts of ſtones, each cart carrying from ſeven to nine cwt. will build a rood; the carriage at 2d. per cart for half a mile's diſtance.

Warmth is undoubtedly extremely beneficial to hedges; and the walls give an effectual ſhelter, which, in expoſed ſituations is abſolutely neceſſary for rearing young hedges; and they likewiſe preſerve a proper degree of moiſture about the roots. If the hedges have been planted for ſix or ſeven years before the wall is built, cut them over to two or three inches above the ground with a ſharp tool, either in October or November, or early in the ſpring; and erect the wall as quickly in that ſeaſon as poſſible (the ſpring in this country can ſcarcely be ſaid to begin till the end of March. It is almoſt impoſſible to imagine the rapidity with which hedges grow in favourable ſituations. Mr Erſkine had one cut over in the ſpring, and by the end of the year it was almoſt as high as the wall. In three years he ſuppoſed, that not even the Highland ſheep, who eaſily overleap a wall of four feet and a half in height, would have been able to break through it.

Reaſons for planting oak trees in hedges.

Notwithſtanding the reaſons that have been given already againſt the planting of timber trees in hedges, we find the practice recommended by ſome authors as one of the beſt ſituations for raiſing ſhip-timber. The reaſons are, that the roots have free range in the adjoining encloſures, and the top is expoſed to the exerciſe

ercise of the winds; by which means the trees are at once enabled to throw out strong arms, and have a large spreading head at the same time; so that we thus at once obtain quickness of growth with strength and crookedness of timber. Well trained timber trees, it is alleged, are not prejudicial to hedges, though pollards and low spreading trees are destructive to the hedge-wood which grows under them; neither are high trees prejudicial to corn fields like high hedges and pollards, which prevent a proper circulation of air; and in Norfolk, where the cultivation of grain is carried on in great perfection, such lands are said to be *wood-bound*. But when a hedge is trimmed down to four or five feet high, with oaks interspersed, a circulation of air is rather promoted than retarded by it: and a trimmed hedge will thrive quite well under tall-stemmed trees, particularly oaks. For arable enclosures, therefore, hedges are recommended of four or five feet high, with oak-timbers from 15 to 25 feet stem. Higher hedges are more eligible for grass-lands: the grasses affect warmth, by which their growth is promoted, and consequently their quantity is increased, though, perhaps, their quality may suffer some injury. Upon bleak hills, and in exposed situations, it will be proper to have two or even three rows of hedge-wood, about four feet distant from each other; the middle row being permitted to reach, and always to remain, at its natural height: whilst the side rows are cut down alternately to give perpetual security to the bottom, and afford a constant supply of materials for dead hedges and other purposes of underwood.

Hedges of whins or furze.

"Whins (furze) have been often employed, says Dr Anderson, as a fence when sown upon the top of a bank.

Fences. bank. They are attended with the convenience of coming very quickly to their perfection, and of growing upon a ſoil on which few other plants could be made to thrive; but in the way that they are commonly employed, they are neither a ſtrong nor a laſting fence. The firſt of theſe defects may, in ſome meaſure, be removed, by making the bank upon which they are ſowed (for they never ſhould be tranſplanted) of a conſiderable breadth; in order that the largeneſs of the aggregate body, conſidered as one maſs, may, in ſome meaſure, make up for the want of ſtrength in each individual plant. With this view, a bank may be raiſed of five or ſix feet in breadth at the top, with a large ditch on each ſide of it; raiſing the bank as high as the earth taken from the ditches will permit; the ſurface of which ſhould be ſowed pretty thick with whin ſeeds. Theſe will come up very quickly; and, in two or three years, will form a barrier that few animals will attempt to break through, and will continue in that ſtate of perfection for ſome years. But the greateſt objection to this plant as a fence, is that, as it advances in ſize, the old prickles always die away; there being never more of theſe alive at any time upon the plant, than thoſe that have been the produce of the year immediately preceding; and theſe thus gradually falling away, leave the ſtems naked below as they advance in height; ſo that it very ſoon becomes an exceeding poor and unſightly fence; the ſtems being entirely bare, and ſo ſlender withal as not to be able to make a ſufficient reſiſtance to almoſt any animal whatever. To remedy this great defect, either of the two following methods may be adopted. The firſt is to take care to keep the bank always ſtored with young

plants;

plants; never allowing them to grow to ſuch a height as to become bare below: and it was principally to admit of this, without loſing at any time the uſe of the fence, that I have adviſed the bank to be made of ſuch an unuſual breadth. For if one ſide of the hedge be cut quite cloſe to the bank, when it is only two or three years old, the other half will remain as a fence till that ſide become ſtrong again; and then the oppoſite ſide may be cut down in its turn; and ſo on alternately as long as you may incline: by which means the bank will always have a ſtrong hedge upon it without ever becoming naked at the root. And, as this plant, when bruiſed, is one of the moſt valuable kinds of winter food yet known for all kinds of domeſtic animals; the young tops may be carried home and employed for that purpoſe by the farmer; which will abundantly compenſate for the trouble of cutting, and the waſte of ground that is occaſioned by the breadth of the bank.

"The other method of preſerving a hedge of whins from turning open below, can only be practiſed where ſheep are kept; but may be there employed with great propriety. In this caſe it will be proper to ſow the ſeeds upon a conical bank of earth, ſhoved up from the ſurface of the ground on each ſide without any ditches. If this is preſerved from the ſheep for two or three years at firſt, they may then be allowed free acceſs to it; and, as they can get up cloſe to the foot of the bank upon each ſide, if they have been accuſtomed to this kind of food, they will eat up all the young ſhoots that are within their reach, which will occaſion them to ſend out a great many lateral ſhoots: and theſe being continually browſed upon, ſoon become as cloſe as could

Fences. be deſired, and are then in no ſort of danger of becoming naked at the root, although the middle part ſhould advance to a conſiderable height.

Where furze or whins are to be uſed either as a fence by themſelves, or in aſſiſtance to another, it is perhaps more proper to uſe the French ſeed than that produced in Great Britain, as the former ſeldom ripens in this country, and conſequently cannot, like the latter, overrun the adjacent encloſures. It may be had at the ſeed-ſhops in London, and one pound will ſow 40 ſtatute roods. When uſed as an aſſiſtant to a hedge, it is more proper to ſow it on the back of the bank than on the top of it; as in this caſe it is more apt to overhang the young plants in the face of the bank; whilſt in the other it is better ſituated for guarding the bank, and preventing it from being torn down by cattle. The method of ſowing is as follows: Chop a drill with a ſharp ſpade about two-thirds of the way up the back of the bank, making the cleft gape as wide as may be without breaking off the lip; and having the ſeed in a quart bottle, ſtopped with a cork and gooſe quill, or with a perforated wooden ſtopper, trickle it along the drill, covering it by means of a broom drawn gently above and over the mouth of the drill. Cloſing the drill with the back of the ſpade, ſhuts up the the ſeeds too much from the air, and thus keeps them too long from riſing.

Gooſeberry hedge. We do not know that any perſon has yet attempted to make uſe of the gooſeberry for the purpoſe of making hedges, though few plants ſeem better adapted for that purpoſe. It grows readily. Some varieties of it riſe to a conſiderable height, and by the ſtrength and number of its prickles, it would effectually prevent any

any animal from breaking through. It is ſaid, that ſome ſpecies of the mulberry not only grow and thrive in England, but are capable of being reared to perfection in Scotland, as has been experienced at Dalkeith. As the leaves of this plant are the food of the ſilk-worm, which produces the moſt beautiful and valuable of all the materials that can occupy the loom, it is perhaps worthy of attention how far it might be worth while to rear it as a fence in hedge-rows, with a view to its becoming the baſis of a valuable manufacture. Fences.

Dry ſtone walls are ſometimes erected of thoſe round and apparently water-worn ſtones which the plough throws out, and which may be gathered in every field. They are uſually coped with ſod. This, however, is a very indifferent fence. In moſt inſtances it is erected by common labourers, and is therefore ill conſtructed, as not even to be of an uniform thickneſs from top to bottom. The round figure of the ſtones alſo prevents the building from being well bound together. Even the cattle rubbing themſelves againſt it are apt to make conſiderable gaps, which render conſtant attention neceſſary to keep it in repair. It is cheaply executed, however, and affords the means of at once fencing the land and clearing it of ſtones. When dry ſtone walls are ſkilfully built by maſons, and made with quarried ſtones finiſhed with a good coping, they look well, and laſt for many years; but the coping ought to be of ſtone, and not of turf or mud. Fences of dry ſtone walls.

To render ſtone and lime walls valuable as fences, they ſhould have a broad baſe, and have a foundation ſufficiently deep to prevent their being injured by the looſening

Fences. loofening of the ſoil which is produced by froſt. This fence is very durable, but it is alſo very expenſive. To be in perfection, it ought to be executed not with common ſtones gathered from the fields, but with ſtones from the quarry: It ought to be ſecured at the top with a coping of ſtone of the flag-kind laid together in ſuch a way as to render the wall narrow at the top like the roof of a houſe. If the coping is neglected, the moiſture ſoon finds its way into the heart of the wall, and it is alſo liable to various accidents from idle perſons climbing over it.

The Galloway dike. The Galloway dike owes its name to the county in which it was firſt uſed. It conſiſts of a broad building of dry ſtones tapering upwards. Large flat ſtones are then laid on like a coping, and project over the wall on each ſide. Above thoſe ſtones large rugged round ſtones are laid, and ſmaller ſtones above theſe, ſo as to admit a free paſſage to the winds which whiſtle through them. The Galloway dike is never raiſed very high, but its tottering appearance ſo terrifies the cattle and ſheep, that they dare not touch it; ſo that it is a very effectual fence, though it neither affords ſhelter nor ornament to the country. It has the advantage, however, of being erected at a very trifling expence; it is not unſuitable to thoſe lower parts of the country in which the ſhelter of high trees and hedges would prove pernicious to the corn crop, and where the confinement of the ſtock is all that is required.

Clay is ſometimes uſed inſtead of lime for binding ſtone walls; but it is a very defective cement; for if froſt ſuddenly ſucceed to wet weather it is apt to ſwell and to tumble down at the next thaw. To guard againſt the effects of moiſture, theſe ſtone and clay

walls

walls are ſometimes rough-caſt or coated over with lime. If the coating is very thick and the wall properly coped, it may laſt in this way as long as a wall of ſtone and lime. Fences.

For the ſake of the appearance, dry-ſtone walls have ſometimes two or three inches at the top of them on each ſide lipped or waſhed with lime, which adds nothing to their ſtrength, but gives them the appearance of being built entirely with ſtone and lime. With the ſame view, and with the ſame effect, they are ſometimes alſo broad-caſt or coated with lime over their whole ſurface. Dry-ſtone walls, after they are finiſhed, are ſometimes pinned and harled, or rough-caſt, that is, the maſon fills up all the interſtices of the building with ſmall ſtones, and afterwards coats it over with lime, which adds conſiderably to its durability.

Low dry-ſtone walls have ſometimes a light paling at the top, which gives them a handſome appearance.

Brick walls are ſometimes uſed where ſtones are extremely ſcarce, but they are chiefly employed for facing garden walls.

Frame walls are conſtructed in the following manner. A frame of boards of the width and height intended for the future wall is placed upon the line that has been dug for a foundation. The frame is filled to the top with ſtones gathered from the adjoining fields, and a quantity of liquid mortar is poured in amongſt them ſufficient to fill up every interſtice. The whole is allowed to remain for a day or two, or longer, till the building is dried ſo far as to have acquired ſome ſtability. The frame is then removed, and placed a little farther on the ſame line, but in contact with the laſt-made piece of wall, and the operation is renewed. Frame walls.

This,

Fences. This is ſuppoſed to have been a very ancient mode of building.

Turf walls are found very uſeful in upland diſtricts for temporary purpoſes, ſuch as for folds, or for protecting young plantations or young hedges. Their ſtrength is ſometimes increaſed, without augmenting the expence of the conſtruction, by intermingling them with ſtones, that is, by forming the wall of alternate layers of turf and ſtone.

Mud walls. Mud walls, with a mixture of ſtraw, are very frequent in many places both of England and Scotland, and they are uſed not only for fences, but alſo for conſtructing the walls of farm houſes and offices, in the poorer parts of the country. They are formed in the following manner. Straw and clay are incorporated with each other, like hair with plaiſter lime, and formed into large pieces. A ſtratum of theſe is laid at the bottom of the intended wall. The different pieces are then firmly kneaded with the hand, and preſſed at each ſide with a flat board, which not only conſolidates, but gives ſmoothneſs and uniformity to the work. Succeſſive ſtrata are added till the wall is reared to its intended height. If walls thus conſtructed are properly coated with lime, to protect them againſt moiſture, they become very durable; and their appearance is not inferior to that of a ſtone and lime building.

Compound fences. Of compound fences, the moſt ordinary is the ſingle hedge and ditch, with or without paling. The mode of planting theſe hedges has been already ſtated on the authority of Lord Kaimes and others; and we ſhall only add, that if a hedge is wiſhed to riſe with rapidity, the ſpot in which it is planted ought to be enriched with lime, compoſt, or other manures, as hedge plants cannot, any

any more than other plants, ſpring rapidly without cul- Fences.
tivation. Where a hedge is planted at the top of a ditch, it may alſo be remarked, that it is doubly neceſſary to give the ditch a proper degree of ſlope, that it may not be undermined by any accident, which would have the effect to lay bare the roots of the hedge, or entirely to bring it down. Where it is wiſhed to render lands encloſed with hedge and ditch cheaply fencible at once, a kind of Galloway dike, conſiſting of ſome rows of large coarſe looſe ſtones, may be placed upon the top of the bank, which will have the effect of protecting the hedge againſt cattle.

The double ditch, with a hedge in the front of each, is now practiſed, particularly on cold lands, in many parts of Great Britain. It may be remarked, that where theſe double ditches are wanted for drains, it is undoubtedly a proper practice; but, in other ſituations, it is exceptionable, as laying out unprofitably a large portion of the ſoil.

When a hedge and ditch is uſed, whether ſingle or double, the hedge is ſometimes placed not at the bottom of the bank, which is the uſual way, but in the middle of it, at ſome height above the ordinary ſurface of the field. In ſuch a mode of planting, the hedge is expoſed to great injury from the bank mouldering down, and from want of proper nouriſhment; but the practice is ſometimes neceſſary upon wet lands, where hedges would not thrive, if placed upon the common ſurface. Sometimes the face of a natural declivity is cut down, in a ſloping direction, to within 18 or 20 inches of the bottom. Here a bed is made and covered with good earth, in which the plants are inſerted. A hedge planted in this way looks formidable, from the ſide facing the

Fences. the bank; but it is expoſed to more accidents, from a failure of its ſoil in conſequence of froſts, than if planted at the bottom of the bank.

Hedge and bank fence. Sometimes what is called a hedge and bank, or hedge on the top of a bank, is made uſe of. It conſiſts of a bank of earth taken from the adjoining grounds, broad at bottom and tapering towards the top, along the ſummit of which the hedge is planted. Such hedges are extremely liable to decay, in conſequence of the artificial mound on which they ſtand, being unable to retain ſufficient moiſture for their ſupport, or being waſhed away from about their roots.

Devonſhire fence. The Devonſhire fence reſembles the one now deſcribed. It conſiſts of an earthen mound ſeven feet wide at bottom, and four feet at the top, and five in height. In the middle of the top of it a row of quicks is planted; and on each ſide at two feet diſtance a row of willow ſtakes, of about an inch in diameter each, and from eighteen inches to two feet in length, is ſtuck in ſloping a little outwards. Theſe ſtakes take root, and form a kind of live fence for the preſervation of the quicks in the middle.

Palings are frequently employed for the protection of young hedges, whether planted on the plain ſoil or on the top of a ditch: dead hedges, of the kinds formerly mentioned, are alſo employed for the ſame purpoſe. The dead hedge is preferable to the paling, as it ſhelters the young plants from the inclemency of the weather. The dead hedge, however, ought always to be at ſome diſtance from the living one, to allow the latter freely to put forth its branches. As already noticed, walls of different kinds are ſometimes erected, whether Galloway dikes or of ſtone and lime,

for

for the protection of young hedges; but there is a mode of making a hedge in the middle or in the face of a wall which deſerves attention. It is executed in the following manner: The face of the bank is firſt cut down not quite perpendicular, but nearly ſo. A facing of ſtone is then begun at the bottom, and carried up regularly in the manner that ſtone walls are generally built. When it is raiſed about eighteen inches or two feet high, according to circumſtances, the ſpace between the wall and the bank is filled up with good earth, well broke and mixed with lime or compoſt. The thorns are laid upon this earth in ſuch a manner, as that at leaſt four inches of the root and ſtem ſhall reſt upon the earth, and the extremity of the top ſhall project beyond the wall. When the plants are thus regularly laid, the roots are covered with earth, and the wall continued upwards, a hole having been left which each plant peeps through. As the wall advances upwards, the ſpace between it and the bank is gradually filled up; when completed the wall is finiſhed with a coping of ſod or of ſtone and lime. When the plants begin to vegetate, the young ſhoots appear in the face of the wall, riſing in a perpendicular direction. If is ſaid, that Sir James Hall of Dunglaſs has adopted this mode of encloſing to a conſiderable extent in Eaſt Lothian; that the hedges have made great progreſs; and that they exhibit, upon the whole, an extremely handſome appearance.

Fences.

Hedge in the face of a wall.

Whatever may be thought of the propriety of planting trees in hedge-rows, there can be no doubt that in certain ſituations the addition to a hedge, or hedge and ditch, of a belt of planting is a valuable acquiſition to its owner and to the country. It is certain, however,

Belts of planting

as

Fences. as formerly ſtated, that in low rich ſoils where corn is chiefly cultivated, particularly when ſurrounded by hills, belts of planting are not only unneceſſary, but even hurtful to the crop. But there are other ſituations in which they are of the higheſt value. The peninſula, which forms the county of Caithneſs, is ſaid to be a proof of this. Its ſoil is of a good quality, but its value is greatly impaired by its being expoſed to ſea-winds, whoſe ſeverity checks all vegetation. Many tracts throughout the iſland are nearly in the ſame ſituation; and in all of them nothing more is wanted to improve the country than to interſect it in a judicious manner with hedges and belts of planting. Where belts of planting are meant to remain as an efficient fence, they ought to be of a conſiderable breadth. In poor and cold ſituations the breadth ought to be ſuch as to allow ſpace for planting a great number of trees, which, from the ſhelter they mutually afford, may protect each others growth againſt the ſeverity of the climate. With the ſame view, in cold and expoſed ſituations, the young trees ſhould be planted very thick; perhaps four or five times the number that can grow to a full ſize ſhould be planted. This practice affords a choice of the moſt healthy plants to be left when the plantation is thinned. In belts of planting an error is ſometimes committed of mingling firs, larches, and pines, with oaks, aſhes, &c. with the intention that the evergreens ſhould protect for a certain time the other trees, and thereafter be removed. The effect of which too frequently is, that when the evergreens are taken away, their growth is not only checked for ſeveral years; but being unable, after experiencing ſo much ſhelter, to reſiſt the ſeverity of the climate, they die altoge-

ther.

ther. This is the more likely to happen in conſe- Fences.
quence of the rapidity with which the firs and larches grow; for the oaks and other trees are drawn up along with them, and acquire, in ſome meaſure, the nature of hot-houſe plants, unfit to encounter the blaſts of a northern climate: hence belts of planting ſhould either be made altogether of evergreens, or altogther of deciduous plants, ſuch as oak, aſh, &c. If the evergreens are at all introduced among theſe laſt, it ought to be ſparingly, and at the outſide of the belt, with the view to afford only a moderate degree of ſhelter.

Where fields are meant to remain conſtantly in paſturage, the belts may be made in a ſerpentine, and ſometimes in a circular form, both for the ſake of ornament, and to afford more complete ſhelter; but this cannot be done where the plough is meant to be introduced. Upon a north expoſure, the belts ſhould croſs each other at proper diſtances, to afford more complete ſhelter. Upon a ſouth expoſure, they ought to run from ſouth to north, to afford a defence againſt the eaſt and weſt winds, which are the ſtrongeſt in this country. Belts of planting require themſelves to be fenced. A fence, which is merely intended to protect their growth, may conſiſt of a mud wall; but if a permanent ſecurity is wanted, a hedge and ditch will be neceſſary.

In ſome ſituations, inſtead of the belt of planting, it is cuſtomary to plant only the corners of the fields; and this plan is adviſable, where the country requires but a moderate degree of ſhelter, added to that which it may derive from thriving hedges.

It has been propoſed, that on all ſheep farms of any

Fences. extent, there ought to be one or more circular belts of planting, encloſing a ſpace of about an acre or an acre and a half in the centre, with a ſerpentine road leading through the belt into this encloſure, the uſe of which is evident. In heavy falls of ſnow numerous flocks are ſometimes buried, and the lives of the ſhepherds are not unfrequently loſt in attempting to drive them to a place of ſafety. On ſuch occaſions, the encloſures we have now mentioned would be of the utmoſt value. When a ſtorm threatened, the ſheep might be driven to theſe encloſures, where the ſnow could never be piled up by driving winds; and they might there be fed and remain with entire ſafety. If due care were taken to litter the place, a quantity of valuable dung might be collected, if the ſtorm ſhould remain for any length of time.

The reed fence. The reed fence has hitherto been only uſed in gardens. It conſiſts of a kind of wall, formed by ſewing with wrought yarn bundles of reeds, applied perpendicularly to a railing. This fence ſeems well adapted for giving temporary ſhelter to cattle, but as the materials of it cannot be everywhere found, its uſe muſt be very limited.

Gate-poſts. The entry to every encloſure ought to be ſecured by gate-poſts; which, if circumſtances will permit, ought always to be of ſtone, and, if poſſible, of hewn ſtone, as theſe, when properly conſtructed, will never fail. Trees are ſometimes planted for this purpoſe, and, when they have acquired a certain ſize, they are cut over about ten feet above the ſurface of the ground. Theſe form the moſt durable of all gate-poſts. They ſometimes, however, miſgive; in which caſe it is difficult to repair the defect. When gate-poſts are made

of

of dead timber, they ſhould be ſtrong, and the wood well prepared by a coat of oil paint, as already mentioned. Fences.

Of gates for encloſures there are different kinds. What is called the *ſwing-gate* that croſſes the whole breadth of a carriage road, and is of one piece, is by no means an adviſable form. The length of its bars renders it expenſive, and its great weight with which it pulls againſt the gate-poſt, overſtrains its own hinges, and is apt to bring down the ſide of the gate, unleſs it is erected in a very coſtly and ſolid manner. For this reaſon, a gate with two folding doors is preferable: it hangs upon the gate-poſt only with half its weight, in conſequence of its being divided into two parts. Its hinges are not ſo liable to be hurt by ſtraining, nor are its joints ſo liable to be broke. What is called the *ſlip-bar gate*, conſiſting of three ſeparate bars which are taken out, and put into the gate-poſts every time the entry to the fields is opened and ſhut, is the beſt kind of gate, ſo far as cheapneſs and durability are concerned; but it does not admit of being locked, which renders it unfit for uſe near a publick road, and the opening and ſhutting of it are alſo attended with a conſiderable degree of trouble. Gates.

INDEX.

A

Achillea millefolium, i. 90.
Accounts, how to be kept by farmers, i. 197.
Agriculture defined, i. 1.—wherein it differs from gardening, ib.—is a ſeparate employment, ib.—includes the rearing of cattle, ib.—general importance of, 2, 3, 107.—moral advantages of, to the farmer, 4.—eaſtern, hiſtory of, 6. of the Roman, 10.—of the modern, 18.—board of, 46. theory of, 51.—what it ought to contain, 53.—practice of, 221.—theory of, defective, 51.—obſtacles to the improvement of, 193.
Agroſtis cornucopiæ, ii. 110.
Anderſon, Dr, on draining, 345.—on hedges, ii. 515.
Arſenic uſed to prevent the mildew, i. 163, 487.

B

Barley, chief value of, for malting, i. 57.—culture of, 499.—ribbing, ib.—ſeed, how managed in a dry ſeaſon, 501.—experiments on, 502.—time of ſowing, 503.—culture of, in Norfolk, 506.—in the vale of Glouceſter, 508.—in Cotſwold, &c. 509.—in Yorkſhire, 510.—
Bath Society on wheat ſetting, i. 470.
Beans cultivated broad-caſt, i. 521.—in drills, 525.—with parſnips in Jerſey, ii. 20.—with wheat, i. 576.
Beet, white, i. 75.—culture of, ii. 55.—ſugar made from, by Mr Achard, 318.—culture of, for ſugar, 325.
Black cattle, properties requiſite in, ii. 391.
Blight, a diſeaſe of wheat, i. 154.
Board of Agriculture, i. 46.—their rules for planting potatoes, 538.
Bogle on wheat-ſetting, i. 468.
Brake, i. 271.
Broom, how deſtroyed, i. 151.
Buck-wheat, i. 70.—culture of, 511.
Bulbous foxtail graſs, ii. 102.
Burnet recommended, i. 71.—diſapproved of, 74.—culture of, ii. 100.

Butter, hiſtory of ii. 450.—qualities of, 452.—rules for making, 454.—cream for making, not to be new, 455, churn, 456,—compoſitions for preſerving, 457.—prepared for hot climates, 458.—Eſſex or Epping, ib.—how kept untainted by cabbages and turnips, 461.
Butterfly, corn, i. 173.

C

Cabbages, their properties, i. 66.—render air noxious, 67.—turnip-rooted, ib.—culture of, ii. 43.—quantity on an acre, 47.—repeated tranſplanting recommended, 44.—on watering them, 48.—in the mid-diſtrict of England, 49.—how tranſplanted or earthed, 50.—how protected from caterpillars, 51.
Calves reared without milk, ii. 403.—by Mr Young, 404. in Cornwall, 405.—by Mr Bradſute, 407.
Canary ſeed, ii. 313.
Caraway ſeed, ii. 310.
Cattle, proper to be employed on a farm, ii. 367.—properties requiſite in, ii. 391.—diſeaſes of, 397.—cures for hoven or ſwelled, 398.—ſtall-feeding of, in Germany, 409.—advantages of, 410.—ſtall-fed in two ways, 414.—roots for them to be boiled, 415.—rules for fattening, 418.—feeding of, not brought to perfection, i. 100.
Carrots, i. 67.—culture of, ii. 1.—in Flanders, 4.—in Suffolk and Norfolk, 5.—ſuperior to turnips, 6.—value of, 7.—experiments on, recommended, 8.—lambs fed with, 9.—compared with cabbages, 10.—preferred to potatoes, 11.—to oats for horſes, 12—how uſed to colour butter, 13.—poultry fed with, 14.—ſown in young plantations, 15.
Carſe of Gowrie, mode of draining in, i. 315.
Chain-plough, i. 255.—fence, ii. 508.
Cheeſe deſcribed, ii. 462.—making, 464.—defects, of, ib.—runnet for, how prepared, 465.—double Glouceſter, 469. Cheſhire, 471.—Stilton, 476,—Parmeſan, 478.
Chicory, ii. 110.
Cleaning-harrow, i. 447.
Cloſe, Rev. Mr. on rotations of crops, ii. 185.
Clover, red, ii. 77.—culture of, 78.—of ſowing with drilled barley, 81.—ſeed, how collected, 83.—white, 84.
Crab hedge, ii. 512.
Cole ſeed, ſee *Rape-ſeed*.
Coleworts, ii. 52.
Coriander ſeed, ii. 310.
Corn-butterfly, i. 173.

Coulter of the plough. i. 231.
Crops, culmiferous and leguminous, difference between, ii. 171.
Cultivation, general principles of, i. 110.—of vegetable food, 222.
Cultivator, inſtrument ſo called, i. 269.
Culture of waſte land, i. 422.—particular plants, 454.
Curl in potatoes, i. 174.—hiſtory of, 187.—how prevented, 175.
Cyder fruit, how raiſed, ii. 341.—orchards for, 345.—kinds of, 495.—mill and houſe deſcribed, 483.—wine, 499.
Cyderkin, ii. 498.

D

Dairy, ii. 443.—food of cows for the, 445.—deſcribed, 449.
Dibbling of wheat, i. 480.—
Diſeaſes of plants, i. 153.
Ditches, ii. 502,
Draining, importance of, i. 311.—ſprings, principles of, 335.—diſcovery of the new mode, 337.—practical rules for, 339.—of quarries and mines, 346.—of land wet by ſprings, 332.—the ſide of a hill, 340.—a bog, by letting the water aſcend, 344.—Dr. Anderſon's rules for, 345.—Mr Wedge's mode, 353.—of landlocked bogs, 362.—in Germany, 364.—in Roxburghſhire. i. 365.
Drains, open or hollow, i. 313.—hollow, when not to be uſed, ib.—fit for clay ſoils, 314.—in the Carſe of Gowrie, 315.—open, how made, 317.—hollow, hiſtory of, 318,—how made, 319.—materials for, 321.—duration of, 331.—pipe or ſod, 329.
Drill-huſbandry, ii. 253.—operations of, 254.—inſtruments of the, 258.—arguments for the, 272.—objections to and anſwers, 277. Sir J. Anſtruther on, 281.—general remark on, 288.—not modern, 289.—for turnips, value of, i. 557.
Durno's report on flax and hemp, ii. 296.

E

Erſkine of Mar on ſmut in wheat, i. 164.

F

Fallow, uſes and loſs from ſummer fallow, i. 139.
Fallow-cleanſing machine, i. 281.
Fences, kinds of, enumerated, ii. 501.—of ditches, 502.—of a bank of earth, 505.—of a ha-ha or ſunk fence, ib.

Fences, palings, ii. 506.—for deer parks, 531.—chain, 508.—ſtone wall, 553.—live, 509.—of hedges, 511.—Galloway dikes, 554.—of frame walls, 555.—of mud walls, 556.—compound, ib.—of hedge and bank, 558.—Devonſhire, ib.—of a hedge on the face of a wall, 559.—belt of planting, ib.
Fertility of certain ſoils extraordinary, i. 125.—of the earth, limited, 131.
Findlater, Rev. Mr. on watering meadows, ii. 162.
Feſcue, ſheep's, i. 77.—deſcribed, 82.—appearance when cultivated, ib.—ſoil proper for, 83.—purple, 77.—its appearance when cultivated, 78, 80.
Flax, ii. 290.—culture of, in Yorkſhire, 291.—Mr Bartley's experiments on, 293.—vaſt quantities of, imported, 295.—culture of, in Pruſſia, 296.—in America, 299.—in Ireland, 302.—weeded by ſheep, 303.
Flooding land, ſee *Watering*.
Fly, turnip, i. 171.—how prevented, 567.
Fog, the nature of, and the mode of deſtroying, i. 148.
Fontana on mildew, i. 159.
Forſyth on converting roots into flour, i. 61.—his ſteam apparatus, 63.—on the diſeaſes of fruit trees, ii. 349.
Froſt, effects of, on ploughed land, i. 492.
Fruit, cultivation of, ii. 337.
Fruits, value of, in agriculture, i. 55.—as human food, 56.
Fruit-trees, varieties of, not permanent, ii. 337.—nurſeries for, 339.—exceſs of wood on, 346.—miſſletoe on, 347.—moſs on, how removed, 351.—duration of, how lengthened, 348.
Fruit-liquors, making of, ii. 483.—cyder houſe for, ib.—correcting of, 496.—caſking, 497.—bottling, 498.
Fruit, mode of gathering, grinding, &c. ii. 456.

G

Galloway dikes, 554.
Garden mould, the nature of, i. 114.—hedges, ii. 513.
Gates, ii. 563.
Gate poſts, ii. 563.
Geeſe, ii. 441.
Grain, chiefly uſed as human food, i. 56.—kinds of, the ſame in nature, 58.
Grant, Sir Archibald, on early potatoes, i. 547.
Graſs, ii. 55.—culture of, for hay and paſturage different, 56.—without the aid of the plough, 58.—by ſheep, 60.

Graſs, culture of, by the aid of the plough, ii. 66.—ſown with or without corn, 69.—kinds of, to be cultivated, 75.—red clover, 77.—lands improved by flooding, 119.—bulbous foxtail, 102.—great meadow, 103.—creeping meadow, ib.—vernal, ib.—creſted dogs tail. 104.—cock-tail or feather, 105.—fine bent, ib.—mountain hair, 106.—flote feſcue, ib.—meadow foxtail, 107.—cow, 108.—annual meadow, 109.—tall oat, 112.—yellow oat, ib.—rough oat, ib.—upright broom, ib.—blue dogs-tail, ib.—rough cocks-foot, 113.—tall feſcue, ib.—hard feſcue, ib.—meadow cat's-tail, ib.—how to make experiments on, ib.—Rev. Mr Young on mixtures of, 116.
Grazing compared with the plough, i. 92.
Grenet's mode of granulating potatoes, i. 60.
Grubs, i. 170, 529.

H

Ha-ha, or ſunk fence, ii. 505.
Harrow, i. 272.—improved, 274.
Hawthorn hedges, ii. 511.
Hay-making, ii. 200.—of red clover, 202.—by Dr Anderſon, 203.—in Courland, 208.
Headrick, Mr, on moſs improvement, i. 410.
Hedges, dead, ii. 510.—directions for planting, 511.—hawthorn, ib.—black thorn, holly, crab, ib.—garden, 513.—flowering ſhrubs for, 514.—Dr Anderſon on, 515.—of willow, 516.—in expoſed ſituations, 517.—black alder, 520.—birch, 521.—hornbeam, 526.—decayed, how mended, 527.—Kames on, 531.—of old roots, 533.—of thorn, how planted, 534.—ſecured, 537.—trained, 536.—plaſhed, 537.—whins for, 549.—Bakewell's, 539.—repaired, 542.—thickened, 544.—Mr Erſkine's, 545.—of gooſeberry, 552.
Hemp, culture of, in Pruſſia, ii. 296.—in America, 299.
Hiſtory of Agriculture, i. 4.
Hogs, how reared and fattened, ii. 419.—Young on, 420.
Hogfly deſcribed, ii. 426.
Holcus lanatus, i. 85.
Holly, ii. 512.
Hops, i. 314.—once forbidden in malt liquor, ib.—culture of, in Eſſex, 315.
Horſes and oxen compared, ii. 368.—gradually gaining a preference over oxen, 374.—kinds of, 381.—Norfolk breed of, 383.—Lanarkſhire, ib.—expence of keeping, 387.

Horſes, roots uſed in feeding, 388.—whins for feeding, i. 70.
Huſbandmen, why they often prefer cattle to corn, i. 107.—inſtruments of, 222.

I

Inſects injure vegetables, i. 169.—how deſtroyed, i. 170.
Irrigation, ſee *Watering*.

K

Kail, ſee *Coleworts*,
Kirwan on ſoils, i. 122.—on manures, ii. 247.—

L

Leaſes, too ſhort, an obſtacle to agriculture, i. 216.
Levelling of ridges,
Lime deſtroys one kind of poor ſoil, i. 121.—improves paſture lands, ii. 63.—fertilizes another, i. 122.—Anderſon on, 123.—water deſtroys inſects, 169.—See *Manure*.
Lucern, i. 91.—culture of, ii. 96.—French culture of, 99.

M

Manure, ii. 215.—Lord Meadowbank's mode of converting moſs into, 217.—Mr Young on, 231.—uſed in Norfolk, 237.—mid-diſtrict of England, 238.—Kirwan on, 247.—lime as a, 240,—on paſtures, 63, 243.—of limeſtone in powder, ib.—gypſum, 245,—ſea ſand, 247.
Marl, i. 135. ii. 242,
Marſhal on peaſe, i. 517.
Meadowbank, Lord, on manure, ii. 217.
Meadows, how watered, ſee *Watering*.
Mildew, a diſeaſe of wheat, i. 158.
Milk vetch, i. 86.—qualities of, 87.
Monro's cure for ſwelled cattle, ii. 398.
Moor, how to be cultivated, i. 424.
Moſs, nature and origin of, i. 367.—black and yellow, 369.—of Kincardine removed by labour, 380.—how improved by Mr Smith, 410.
Moſſes produced by cutting down foreſts, i. 370.
Mould-board of the plough, ſee *Plough*.

N

Nature, proceſs by which ſhe fertilizes the earth, i. 114.

O

Oats, value of as human food, i. 57.—culture of, 493.—in Norfolk, 495.—ploughed down, 496.—wild, a weed in the Vale of Glouceſter, ib.—culture in mid-diſtrict of England, 497.—Yorkſhire, ib.—ſingular mode of thraſhing, 498.—black, experiment on, ib.
Obſtacles to agricultural improvement, i. 193.
Obſtructions to cropping, how removed, i. 305.
Opinions on the cauſe of mildew, i. 158.
Oxen and horſes compared, ii. 368.—difficulty of ſhoeing, 369.—calculations for and againſt, 370.—moveable harneſs houſe for, 372.—gradually going into diſuſe, 374.—calculations againſt, 375.

P

Palings, ii. 506.
Paring and burning how far uſeful, i. 425.—improves paſtures, ii. 65.
Parſnips, culture of, too much neglected, ii. 16.—Mr Hagard's mode, 17.—in France, 18.—in Jerſey with beans, 20.
Paſturage and agriculture compared, i. 103, 107.
Patent ward-cutter, i. 262.—ſowing machine, 284.
Pea, everlaſting, i. 90.
Peaſe, culture of, i. 514.—drilled, 515. crops of, not to be repeated. 517.—Marſhal on, ib.—culture of, in Suffolk, 518.
Pickles to prevent ſmut in wheat, i. 161.
Plants, culmiferous and leguminous, i. 454.—culture of particular, 455.—diſeaſes of, 153.
Plough, i. 222.—its value, 223.—may be improved, ib.—the taſk it performs, 224.—general form of, 225.—advantages of the form of, ib.—its parts, 226.—ſocks of, 228.—breadth of the ſole of, ib.—ſole to be level. 229.—length of, 230.—ſlope of the coulter, 231.—mouldboard of, 232.—poſition of the ſod when turned by the, 236. mode of its action, 241.—point of its draught, 243.—Argyllſhire, 246.—objections to, 248.—Scots deſcribed, 249.
Plough, Scots, properties of, 254.—chain, 255.—ſingle-horſe, 256.—Rotheram, 257.—paring, 258.—four-coultered, 259.
Poa pratenſis, ii. 103.—compreſſa, ib.—trivialis, 108,—annua, 109.
Population greateſt where vegetable food is uſed, i. 105.

Potato ſtarch,
Potatoes,—granulated by Mr Grenet, in i. 60.—curl in, 174.—how prevented, 175, &c.—general culture of, 526.—particular culture, 528.—Grub in, 529.—culture on ſmall ſpots, 531.—on lazy-beds, 532.—mode of taking up and preſerving, 534.—cluſtered, experiments on, 535.—rules for planting by the Board of Agriculture, 538.—varieties, how obtained, 543.—raiſed from ſeed, ib.—if they degenerate, 545.—early crops, how obtained, 547.—planted by ſcooping out the eyes, 548.
Poultry, ii. 437.—proper mode of keeping, 439.—profit from, doubtful, 440.
Poverty an obſtacle to agricultural improvement, i. 209.
Practice of agriculture, i. 221.
Proceſs by which nature fertilizes the ſoil.

R

Rabbits, value of, ii. 436.
Radiſhes ſaid to baniſh the turnip fly, i. 173.
Rape ſeed, advantage of cultivating, ii. 304.—ſowing of, 305.—Northamptonſhire culture of, 306.—Brabant culture of, 308.
Reaping corn and hay crops, ii. 191.—manner of, by the ſcythe or ſickle, 192.
Rib-graſs, ii. 90.
Rice-balking explained, i. 476.
Ridges, i. 437.—kinds of, on various ſoils, 438.—beſt mode of levelling, 443.—when not to be levelled, 442.—proper direction of, 446.—narrow, advantageous, ib.
Roller, i. 278.
Rolling, effects of, i. 279.
Root of ſcarcity, i. 76.—ii. 53. ſee *Beet*.
Roota baga, ſee *Swediſh* turnip.
Roots uſed as human food, i. 58.—in ſome reſpects more valuable than grain when uſed as food, 59.—their defects as food, ib.—wherein they differ from grain, 60.—how rendered equal in value to grain, ib.—Forſyth's proceſs for reducing to flour, 61.—when given to cattle, ſhould be boiled, ii. 415.—mode of boiling by ſteam, 416.
Rotation of crops, ii. 170.—principles of, 174, 175.—importance of, 176,—Young's experiments on, 179.—of graſs and corn, 180.—Cloſe on, 184.—on waſte lands, i. 435.—on clay ſoils, ii. 187.—marſh land, 188.
Rotheram plough, i. 257.

Runnet

Runnet for cheeſe, ii. 465.
Rye, i. 455.
Rye-graſs, ii. 85.—kinds of, 86.

S

Saffron, diſeaſes of, i. 169.
Sainfoin, culture of, ii. 90.—in England, 93.—number of cattle it will maintain, 95.
Scarcity, root of, ſee *Beet*.
Scots plough, i. 249.—properties of, 254.
Scythes recommended for reaping, ii. 194.—ſhort French, 196.
Service-tree, ii. 518.
Sheaves, ſize of, ii. 197.
Sheep, paſtures improved by, ii. 60.—experiments on feeding with roots, 432.
Sheep's feſcue graſs, i. 77.
Shrubs, deſtroyed by flooding the land, i. 153.—for hedges, ii. 514.
Smith, a moſs improver, i. 410.
Smut, account of, i. 158.
Sock of the plough, i. 228.
Soils, kinds of, i. 112—132.—conjecture about the cauſe of exhauſtion of, i. 117.—if ever perpetually fertile, 125, 128.—pulverized by certain vegetables, 143.—improved by mixture, 130.—by pulverization, 138.
Sole of the plough, i. 228.
Somervell, Robert, Eſq. on blight and ſmut, i. 154.—on fences, ii. 500.
Sowing-machine, i. 284.
Springs, the nature of, i. 332.
Stacks, covering of, ii. 199.
Stones, how removed, i. 305.
Sugar, ſee *Beet*.
Sward-cutter, patent, i. 262.
Swediſh turnip, ii. 33.—culture of, in Nottinghamſhire, 36. Midlothian culture of, 38.—Lancaſhire culture of, 40.—bad kind of, to be avoided, 42.

T

Tare, blue, i. 89.
Teaſel, ii. 310.
Theory of agriculture, i. 51.
Thraſhing-machine, i. 296.

Timber

Timber trees, ii. 352.—advantages of planting, 353.—culture of 358.—planting of, on farms recommended by Mr Young, 363.—Earl of Fife's plantations, 361.—where plantations eligible or not, 365.
Timothy graſs, i. 92.
Trees for fruit, ſee *Fruit-trees.*
Turkeys, ſee *Poultry.*
Turnip-rooted cabbages, culture of, ii. 24.—how raiſed for tranſplanting, 27.—number of ſheep fed on an acre of, 31.
Turnip, Swediſh, ſee *Swediſh* turnip.—cabbage, culture of, ii. 42.
Turnip fly, remedies againſt, i. 172, 567.
Turnips, i. 67.—culture of, 549.—different ſorts of, 552.—ſowing of, drill and broad-caſt, compared, 556.—with ſalt manure in Cornwall, 553.—value of, 563.—mode of preſerving, 564.—ſown with grain, 575.—beans, 576.—inſtrument for tranſplanting, 583.—Norfolk culture of, 585.—early, 586.—raiſed for ſeed, 588.—mode of ſcaring birds from, 590.—drawing, ib.—ſnow ſledge for, 591.

V

Vegetable food more abundant than animal, i. 105.
Vegetables, their value abſolute or relative, i. 53.—uſeful directly or indirectly, 54.—profit from, how influenced, 101.—nature of their growth, 111.—are the food of each other, 120.—ſome pulverize the ſoil, 143.—ſome ſeem to enrich it, 146.—diſeaſes of, 153.—injured by inſects, i. 169.—proper for improving the ſoil, 138.—articles of commerce, ii. 290.
Vetch, buſh, i. 89.
Vetchling, yellow, i. 88.

W

Waſte lands, how cultivated, i. 422.—rotation of crops on, 435.
Watering meadows, hiſtory of, in England, ii. 119—in Italy, &c. i. 18.—advantages of, ii. 121.—land capable of, 124.—by ſprings or rivulets, 125.—terms of art uſed in, 127.—principles of, 136.—Mr Wright's mode of, 137.—uſed water if good for, 139.—works, how repaired for, 141.—Wimpey's opinion on, 144.—land floods for, 147.—how graſs conſumed after, 150.—ſpringy meadows improved by, 153.—hill ſides improved by, 154.—advantage of rolling while, 162.—explained by the Rev. Mr Finlater, ib.

Weeds, how deſtroyed, i. 147.—annual and perennial, ib.—perennial, how deſtroyed, 148.
Wetneſs cauſed by rain or ſprings.
Wheat, diſeaſes of, i. 145.—after clover, 459.—fallowing for, 460.—ſetting, 464.—propagated by dividing the roots, 467.—culture in Engliſh diſtricts, 475.—rice balking for, 476.—how dibbled, 480.—ſown with turnips, 489.—beans, 576.
Whins, food for horſes, i. 70.
Willow hedges, ii. 516.
Woad, ii. 313.

Y

Young, Arthur, Eſq. on irrigation, i. 60.—ſmut in wheat, 163.—cluſtered potatoes, 535.—on the culture of parſnips in France, ii. 18.—on timber, 363.—rotation of crops, 176.—experiments by, on rotations, 179.—on rearing and fattening hogs, 420.—Rev. Mr, on graſſes, ſee *Graſs*.—on rotations of crops, 182.

Printed by A. Bell, Fountainbridge.

Fig. 1.

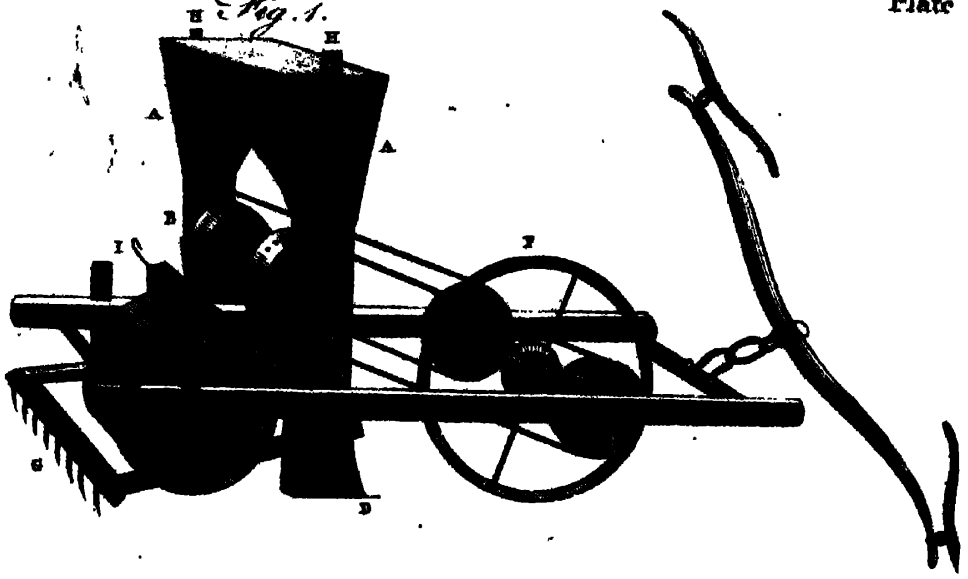


Fig. 2.

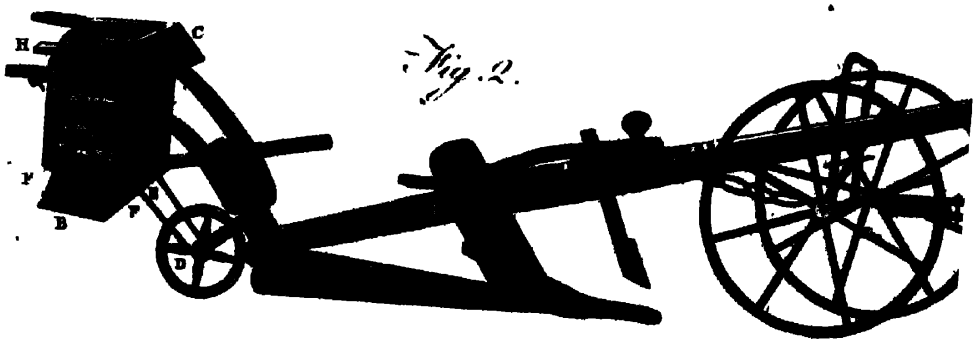


Fig. 3.

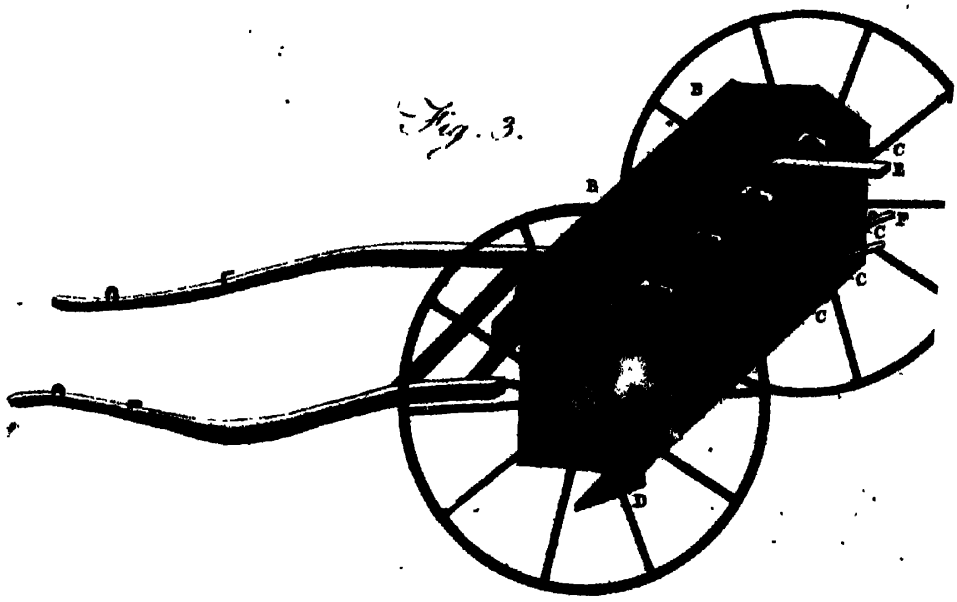


Fig. 1.

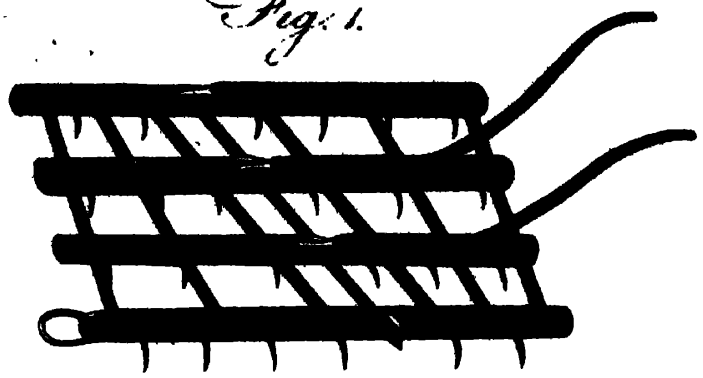


Fig. 2.

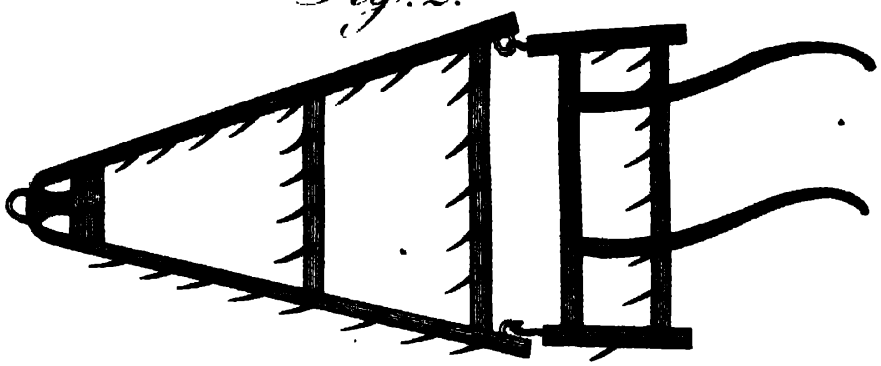


Fig. 3.

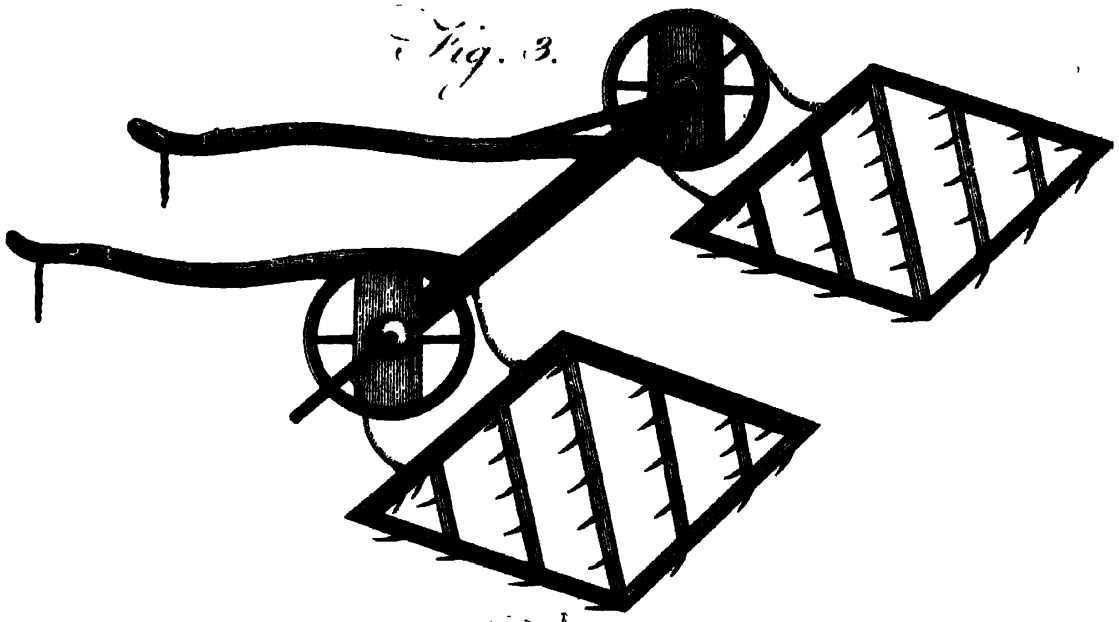


Fig. 4.

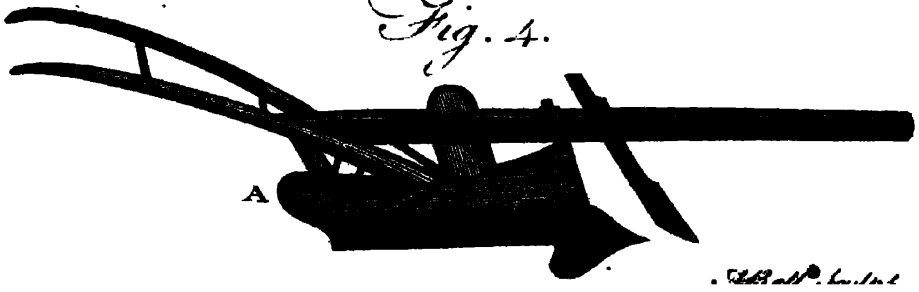


Fig. 1.

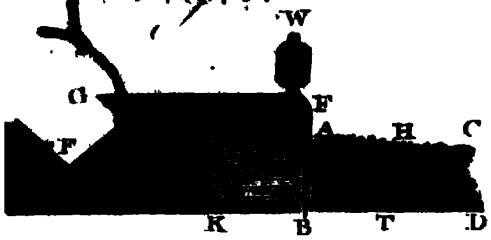


Fig. 2.

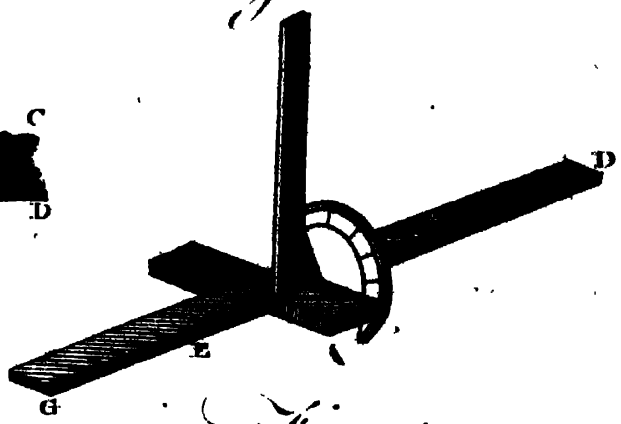


Fig. 3.

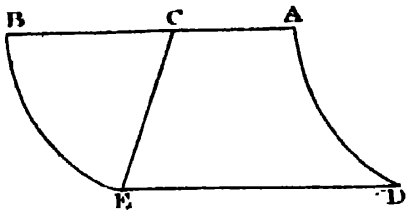


Fig. 4.

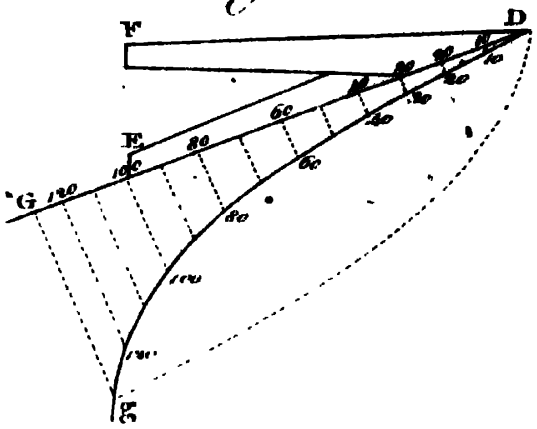


Fig. 5.

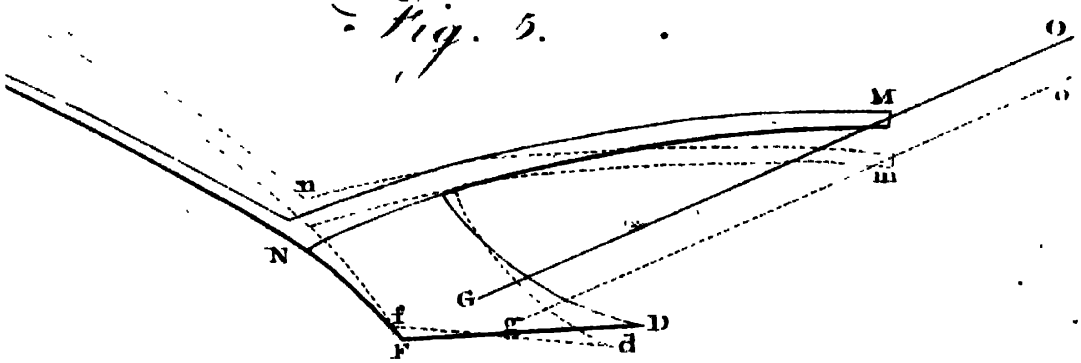


Fig. 6.

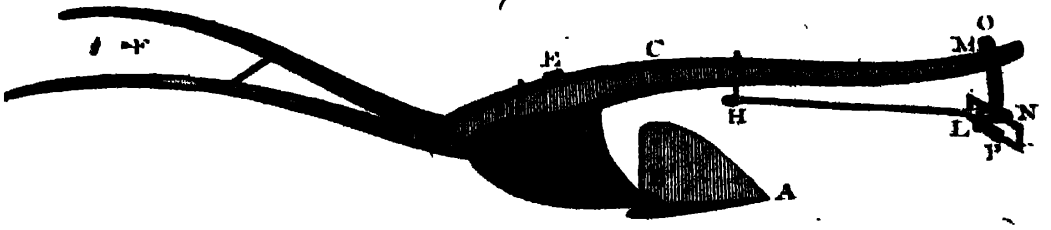


Plate XIV.

Fig. 1.

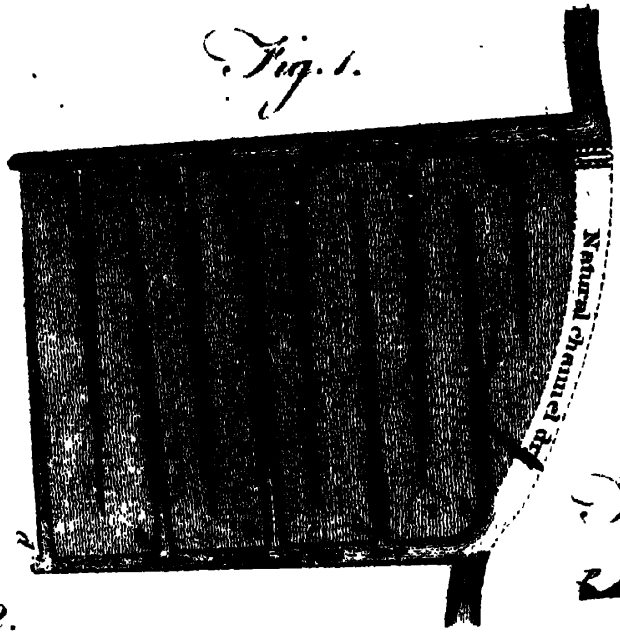


Fig. 3.

Fig. 2.

Fig. 4.

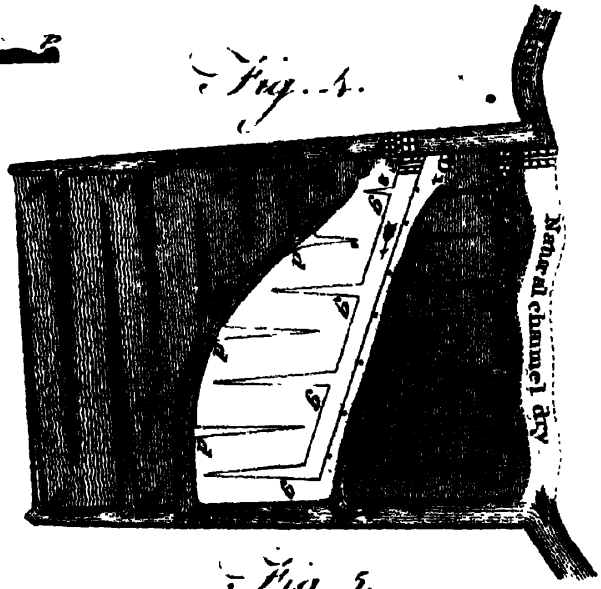
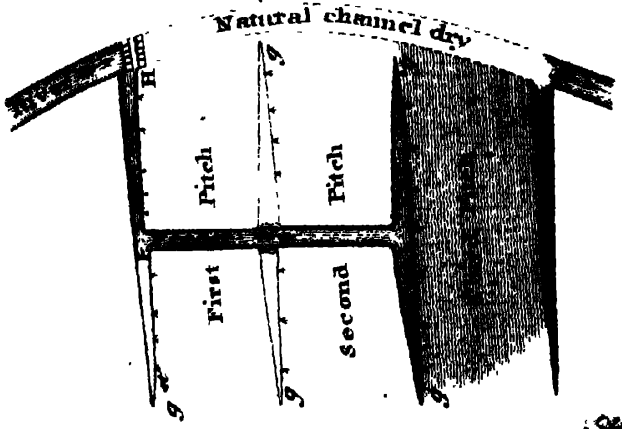
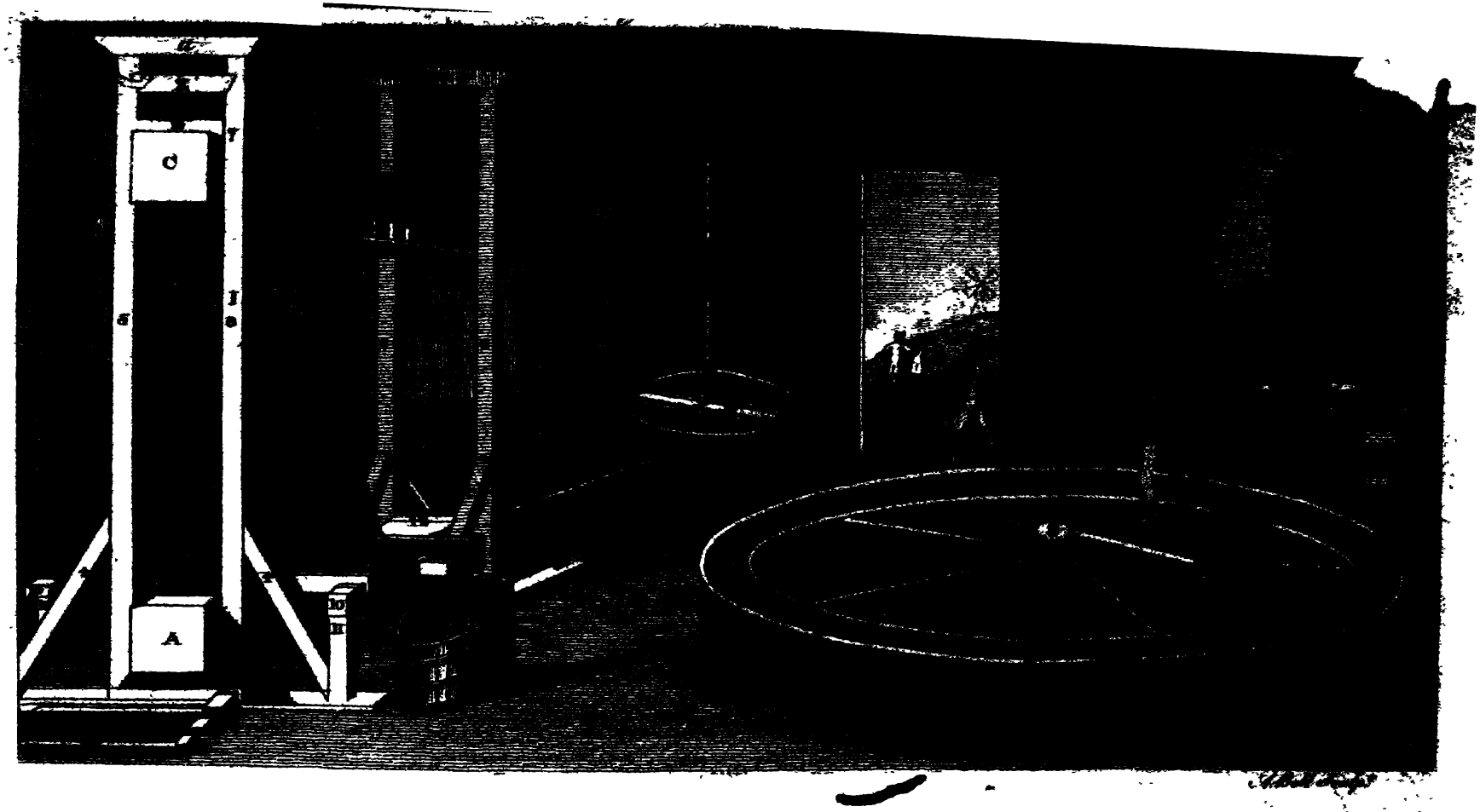


Fig. 5.




C
A